Department of Forensic Sciences
Forensic Science Laboratory Division

Forensic Chemistry Unit
Training Manual

Forensic Chemistry Unit Training Manual

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1.0 Training Goals and Objectives

1.1 Overview of the Training Manual

1.1.1 The purpose of this manual is to provide a format for training new employees in the Forensic Chemistry Unit (FCU) of the District of Columbia, Department of Forensic Sciences (DFS). The training outline provides guidance for training on specific topics of competence for Forensic Chemist Trainees. The complete training program involves traditional instruction (e.g., modules, readings, etc.), as well as apprentice style training and working with qualified chemists. These qualified chemists will act as designated Trainers under the direction of the FCU Manager, FCU Technical Leader, DFS Training Manager and/or designee.

1.2 Format of the Training Program

1.2.1 The FCU Training Program, in its entirety, is designed for the Forensic Chemist who has minimal background or experience in the subject matter. The training program is divided into modules. Each module contains required readings, practical exercises, and study questions, in addition to other duties as assigned. The topics covered in the training program should impart a fundamental understanding of the work that a chemist is expected to understand and perform in the position. The FCU Training Program is intended to be used as a *guide* for training and is not a rigid, inflexible program. Many of the modules do not have to be completed in sequence or order in which they are presented and may be modified depending on the needs of the FCU, DFS, trainer(s), and/or facility availability. The FCU training program may consist of in-service training, training from external agencies, vendors, or a combination.

1.2.2 It is estimated that this training program can be completed, in its entirety, in approximately six (6) months; however, the program may take more or less time to complete depending on the progress of the employee and the circumstances in the FCU. The estimated timeframe for a trainee to complete the training program is dependent upon their assigned duties. It may take more or less time to get practical exposure to some of the techniques in the outline due to the nature of the cases received by FCU.

1.2.3 Satisfactory understanding of the information learned in the modules may be demonstrated through written examinations (grade ≥ 80%), oral presentations, practical examinations and/or exercises. The format of the training program is designed to provide:

1.2.3.1 Self-paced modules to allow for schedule flexibility,
1.2.3.2 Increased time available for hands on apprentice style training,
1.2.3.3 Reduced time from training inception to casework production,
1.2.3.4 Consistent quality of training,
1.2.3.5 Documentation and tracking of training for quality purposes

1.2.4 It is paramount that the Forensic Chemist Trainee understands that the ultimate objective of this training is:

1.2.4.1 Perform essential duties in an analytical chemistry laboratory
1.2.4.2 Demonstrate competence in FCU Methods
1.2.4.3 Demonstrate competence in forensic legal laws and regulations
1.2.4.4 Demonstrate competence in detection of controlled dangerous substances
1.2.4.5 Demonstrate competence in presenting information to the Customer, including testimony in court as an Expert Witness

1.3 Individual Training Plans (ITPs)

1.3.1 Each Trainee will have their previous training, experience, education, published articles, and other credentials reviewed by the FCU Technical Lead and Manager. Additional reviews may be performed by the DFS Training Manager and/or designee. Collected data and information obtained from detailed interviews of the FCU Trainee will be utilized to establish a baseline regarding the Trainee's technical knowledge, skills, and abilities. The knowledge gaps identified will become the basis for an individual training plan tailored to the Trainee’s needs. This process will be a flexible, focused, and efficient approach for training individuals new to the discipline, as well as individuals that have been involved in training programs elsewhere. Demonstrated competency levels may allow a Trainee to test out of a particular module within the Training Program.

1.3.2 The ITP is completed by the FCU Technical Lead, Management, or designee, and documented on an Individual Training Plan form (Document Control Number 12823). The ITP is approved by the FCU Manager/Technical Leader, DFS HR Director and/or designee. Once a training plan has been established for a Trainee, they will be assigned to trainer(s) for the mentorship/supervised casework portion of training.

Trainer(s) will serve as the first line verification that deliverables and milestones within the training program have been met. The progress of the Trainee will be monitored through the use of module checklists, in which successful completion of a module will be indicated by the initials of the Trainee, Trainer(s), and FCU Management.

1.4 Contractors & Previously Experienced Chemists

1.4.1 Technical Assessment Review

1.4.1.1 A technical assessment review of the new employee will be conducted & documented by the FCU Technical Leader and/or Unit Manager.

1.4.1.2 The technical assessment review will include, but not limited to, a review of the new employee's educational background, previous work experience, training & certifications.

1.4.1.3 Based on the results of the technical assessment review an ITP will be completed by the FCU Technical Leader and/or Unit Manager.

1.4.1.4 The ITP will address what additional training is needed and/or competency test requirements that must be successfully completed prior to authorization to perform technical duties.

1.5 Oral Boards

1.5.1 Oral boards are designed to test the Trainee's knowledge on what they have learned in the training program and can serve as a form of competency testing. The purpose of oral boards is to prepare the Trainee for court testimony by exposing them to presentation of technical material throughout the training process and breaking down technical processes into manageable learning modules.

1.5.2 Guidelines for Oral Boards:

1.5.2.1 Oral boards can be formatted as a discussion or presentation. Trainees will be provided a topic / question to address within certain modules. The Trainee shall answer the topic/question orally to a panel, with minimal use of notes. Following the oral presentation by the Trainee, the panel members will ask a series of questions related to the topic, or topics previously mastered, in the training program. Two types of responses may be expected. First, a technical response. Second, there may also be times

where the Trainee will need to respond as if speaking to a jury. It will be made clear during the question which type of response is expected. Notes may be available on hand and are permitted for reference when indicated by the panel.

1.5.2.2 Each question posed by the panel will be documented.

1.5.2.3 The oral board panel will consist of evaluators; observers may be permitted. Three (3) evaluators are required, all evaluators being subject matter experts (i.e. FCU Manager/Technical Leader, Trainer, and qualified chemist). At least one evaluator must be a qualified FCU chemist. Permitting "observers" is at the discretion of the FSL Director and/or FCU Management. Observers can review and provide feedback to the Trainee as to performance; however, they will not be a grading evaluator.

1.5.2.4 Each evaluator is required to document the assessment of the Trainee's responses using an Oral Board Scoring Sheet (Document Control Number 13203). The rubric will show what will be expected of the Trainee and used to evaluate their performance.

1.5.2.5 In order to pass the oral board, the Trainee must demonstrate sufficient knowledge of the subject, while presenting the information in an easy to understand method and sufficiently answer technical questions posed by the panel.

1.6 Thirty (30) Day Progress Review

1.6.1 Each Trainee's progress should be reviewed and reported every thirty days by the FCU Technical Lead or designee. It is the responsibility of the Trainee to report their progress on a FCU 30-Day Progress Report form (Document Control Number 22200). The report should be submitted to FCU Management and the DFS Training Unit at the end of each month for the duration of the training. This 30-Day Progress Report serves as the basis for Trainees to later review their progress. These reports will serve as a reference in months and even years following qualification.

1.7 Training Binder

1.7.1 All practical work conducted by the Trainee shall be maintained in a "Training Binder". Whether notes are maintained electronically or hard copy is up to the discretion of the Trainee. The training binder should be available for final review at the end of the training program. This binder

will serve as a reference in the months and even years following qualification and will assist in documenting the progress during training.

1.8 Practical Examination(s)

1.8.1 Some modules will consist of a practical examination. Trainees must successfully complete the practical component, which could consist of a demonstration, completion of a relevant examination, and/or worksheet and discussion. Documentation will be reviewed by the Trainer(s) or designee.

1.9 Forensic Chemist Competency Test(s)

1.9.1 Regardless of previous experience, each Trainee will be required to pass competency test(s) for all methods/procedures for each discipline and sub-discipline for which they will be expected to perform examinations.

1.9.2 Trainees must receive a passing score of ≥ 80% on any written components, i.e., Technical and Administrative Review competency test(s).

1.9.3 The competency test(s) will include practical components to include, but not limited to, qualitative analysis of Controlled Dangerous Substances and quantitative analysis of Heroin versus a negative control. These will be provided and administered by the FCU Manager/Technical Leader or designee.

1.9.4 Qualitative competency test(s) will each consist of a minimum of two items. Trainees must successfully identify the presence (or absence) of controlled dangerous substances in all items to receive a 100% passing score.

1.9.5 Quantitative competency test(s) will each consist of a minimum of one item. A passing score is defined as |z-score| ≤2. The z-score is calculated according to the following equation:

$$Z_i = \frac{X_i - X}{\sigma}$$

Where:
Z_i = z-score
X_i = trainee result
X = expected value
σ = standard deviation of the expected value

1.10 Mock Trial

1.10.1 Upon completion of the FCU Training Program, the Trainee will participate in mock trials, where applicable. The Trainee will be expected to successfully complete, at minimum, one external mock trial and receive a passing score of ≥ 80%. The external mock trial will be performed by attorneys external to the unit.

1.10.2 The purpose of the mock trial is to evaluate the Trainee's ability to testify as an expert witness in judicial proceedings. The mock trials will highlight the Trainee's oral presentation skills and their ability to relate complex scientific and technical information to lay persons. Sessions will be conducted in a simulated courtroom situation with the proceedings being formal and structured.

1.10.3 The mock trial may cover multiple subcategories of the work that will be performed as a Forensic Chemist. The mock trial(s) may be based on a mock case worked during the mentoring period, notes, diagram(s), and/or report(s). The Trainee will defend their work and/or conclusions reached from the review and/or work. The Trainee will be scored using the Mock Trial Scoring Sheet (Document Control Number 7495). Results and feedback of the mock trial will be provided to the Trainee. The mock trials may also be recorded for future reference.

1.11 Completion of the Program

1.11.1 Successful completion of all the requirements of the training program signifies that the FCU Trainee is qualified to perform as a Forensic Chemist at the DFS. The FCU Manager/Technical Leader must concur in regard to the Trainee's competency before the authorization memo is issued.

1.12 Authorization Memo

1.12.1 A Forensic Chemist Trainee will receive an authorization memo, issued by the FCU Manager/Technical Leader, prior to performing duties within the FCU, following the determination of competency. This authorization memo will clearly outline the techniques the Trainee is competent to perform, whether it is in independent casework examination, case reviews and/or use of equipment. Training in new, or additional, techniques will be appropriately documented and the FCU Trainee will be competency tested prior to assuming case related duties.

1.13 Failure to Meet the Goals of the Training Program

1.13.1 Failing twice in any single module competency or failure to successfully reach all milestones in the estimated time (with exception for situations outside of the control of the Trainee) may constitute a reason for removal from the FCU Training Program.

1.13.2 Resolution of such cases will rest with a committee consisting of FCU Management, FCU Technical Lead, FSL Director, and DFS HR Director or designee.

1.13.3 Remedial training may occur within the training program to address any short coming or exercise that has not been completed to the satisfaction of the Unit Manager/Technical Leader or Trainer(s).

1.13.4 The ITP will be updated to include additional remedial training. The DFS HR Director must be notified to assist with oversight and consistency throughout the Agency. New DFS employees may be subject to dismissal under the probationary appointment agreement.

1.14 Training Documentation

1.14.1 The following shall be maintained and serve as the technical training file:

1.14.1.1 Individual Training Plan
1.14.1.2 Written and oral tests
1.14.1.3 Training module checklists
1.14.1.4 Copies of presentations
1.14.1.5 Competency test(s)
1.14.1.6 30-Day Progress Report(s)
1.14.1.7 Signed and dated Authorization Memo(s)

2.0 Roles and Responsibilities

2.1 FCU Trainee

2.1.1 Shall be responsible for maintaining a training binder (whether hard or electronic copy) which contains the records (*i.e.*, notes, worksheets, photographs, etc.) generated during the training program.

2.1.2 Has the ultimate responsibility for learning the materials necessary to successfully complete a competency test. The Trainee should take an active role in obtaining the information needed (reading, observation, discussing/asking questions, etc.) to do so.

2.1.3 Shall provide 30 Day Progress Reports to the FCU Trainer or Technical Lead within one week of the last business day of each month.

2.1.4 Shall immediately notify the FCU Technical Lead and/or Management of any problems or questions that arise, if their training is not progressing, they are experiencing difficulty with the exercises, or to suggest modifications to the training program.

2.2 Trainer(s)

2.2.1 Shall be competency and proficiency tested in the area of instruction (where applicable) and/or have documented experience working in the subject matter of instruction.

2.2.2 Shall be responsible for demonstrating a particular technique and observing the trainee perform the same procedure where applicable.

2.2.3 Shall reinforce information gained from reading materials through detailed discussion of the technique during demonstration and/or observation, including theoretical and practical aspects.

2.2.4 Shall be responsible for initialing and dating training module checklists.

2.2.5 Shall keep FCU Technical Lead, Management and DFS HR Director (or designee) apprised of any deficiencies or issues that may arise with a Trainee. Deficiencies may include not understanding technical information, not performing work in a timely fashion, refusing to complete assignments, or general personnel issues.

2.2.6 Should participate in oral boards.

2.2.7 May meet with the FCU Technical Lead, Management, and/or DFS Training Manager (or designee) periodically to discuss the progress of the trainee.

2.3 FCU Technical Lead (or designee)

2.3.1 Shall complete ITPs and oversee the training plan for each trainee. Shall monitor the Trainee's progress and ensure the Trainee is adhering to the prescribed timeline for completion of milestones.

2.3.2 Shall review the academic transcripts and training records (as per the position description, if applicable) for newly qualified chemists and approve their qualifications prior to independent casework analysis and document such review

2.3.3 Shall sign off on module checklists, where applicable, and may serve in the capacity as a trainer.

2.3.4 Shall review and approve each 30-Day Progress Report to monitor the progress of the Trainee and submit to DFS Training Unit.

2.3.5 Shall review the Trainee's training binder for completeness and accuracy at the end of the training program.

2.3.6 Shall issue written pass/fail feedback to the trainee at the end of the mock trials.

2.3.7 Shall keep management apprised of ongoing progress of each trainee.

2.3.8 Shall issue the Authorization Memo upon satisfactory completion of all required training.

2.3.9 Shall evaluate the need and assess the extent of retraining chemists, complete and approve retraining plan(s), when necessary.

2.3.10 Shall periodically review the training program for relevance and update the program accordingly with the DFS HR Director (or designee).

2.4 FCU Management (or designee)

2.4.1 Shall review and approve written ITPs for each trainee.

2.4.2 Shall review the academic transcripts and training records (as per the position description, if applicable) for newly qualified chemists and

approve their qualifications prior to independent casework analysis and document such review

2.4.3 Shall issue written pass/fail feedback to the trainee at the end of the mock trials.

2.4.4 Shall evaluate the need and assess the extent of retraining chemists, complete and approve retraining plan(s), when necessary.

2.5 DFS Training Unit

2.5.1 Should review each 30-Day Progress Report to monitor the progress of the Trainee.

2.5.2 Shall periodically review the training program for relevance and update the program accordingly with the FCU Manager/Technical Leader.

2.5.3 Shall maintain training documents in technical training file for each trainee.

2.6 External Instructors

2.6.1 Instructors that are external to the DFS will be evaluated and approved, based on their knowledge and experience of the subject matter of instruction, by the FCU Manager/Technical Leader and DFS Training Unit.

3.0 DFS Orientation and Introduction

3.1 Objectives:

3.1.1 Familiarize the FCU trainee with the general operation and organization of the DFS. The trainee will have an understanding of the expectations of the FCU Training Program, quality issues relevant to laboratory operations, and ethical and professional responsibilities of the position. A training plan will be developed for each FCU trainee based on a review of background and experience.

3.1.2 The FCU trainee should have orientation/training in the following:

- 3.1.2.1 DCHR New Employee Orientation
- 3.1.2.2 Attend DFS Onboarding Training
- 3.1.2.3 Meet with Agency Director (will be set up through Management, if available)

3.1.3 The Trainee should have an understanding of the overall structure of the DFS, FSL, and FCU. Topics will include but are not limited to the following:

- 3.1.3.1 DFS Organizational Overview (Onboarding)
- 3.1.3.2 Performance Evaluation/ Expectations (Supervisor/Manager)
- 3.1.3.3 Overview/Tour of the Consolidated Forensic Laboratory (CFL)

3.1.4 The FCU trainee should have an understanding of the practices and procedures of the Quality Assurance Program in place at the DFS. Topics include but are not limited to the following:

- 3.1.4.1 Laboratory accreditation and the quality assurance system
- 3.1.4.2 Review and general understanding of DFS Quality Manuals to include: Quality Assurance Manual (QAM), Department Operations Manuals (DOMs), FSL Laboratory Operations Manuals (LOMs), and Standard Operating Procedures (SOPs) for FCU
- 3.1.4.3 Review and discussion with trainer on FCU SOPs and quality documents that relate to FCU.

3.1.5 The trainee should have an understanding of the ethical and professional responsibilities for FCU chemists to include:

- 3.1.5.1 Professionalism
- 3.1.5.2 Competency and Proficiency

3.1.5.3 Clear Communications

3.1.6 The trainee should have an understanding of general forensic science to include:

3.1.6.1 Definition and scope
3.1.6.2 Structure and organization of crime laboratories
3.1.6.3 Services generally provided by crime laboratories
3.1.6.4 Functions of forensic scientists

3.2 Reading Material:

3.1.1 Quality Assurance Manual (QAM), Department Operations Manuals (DOMs), FSL Laboratory Operations Manuals (LOMs), and Standard Operating Procedures (SOPs) for FCU

3.1.2 Saferstein, Richard. “Chapter 1: Introduction.” *Criminalistics, An Introduction to Forensic Science (10th Edition),* Pearson Education, 2011, pp. 4-24. (Available in DFS library)

3.3 Study/Discussion Questions:

3.3.1 None.

3.4 Practical Exercises/Skills:

3.4.1 The FCU Trainee should automatically receive information pertaining to Objective 3.1.2 as a new employee. If the trainee has not received the information outlined in Objective 3.1.2 **within the first two weeks** of employment, they should notify their first line supervisor.

3.4.2 The FCU Manager will conduct, or appoint a member of the staff, to meet with the FCU trainee to ensure the training outlined in Objectives 3.1.3 – 3.1.6 have been met.

3.4.3 The FCU Trainee will meet with the FCU Technical Lead, FCU Manager and/or DFS Training Unit to discuss prior experience and educational background.

3.5 Demonstration of Competency:

3.5.1 None.

3.6 Documentation:

3.6.1 Completion of the tasks in this module will be documented on the checklist titled "Module 3.0 Checklist – DFS Orientation and Introduction"

MODULE 3.0 CHECKLIST
DFS Orientation and Introduction

Trainee: _____ Trainer: _____

REQUIRED READINGS			
		Trainee Initials & Date	**Trainer Initials & Date**
3.2	Complete required readings for Module 3.0		
TRAINING OVERVIEW			
		Trainee Initials & Date	**Trainer Initials & Date**
3.4.1	Receive DCHR New Employee Orientation, attend DFS Onboarding Training, meet with Agency Director (if available)		
	Trainee has received information related to Union (where applicable)		
	Trainee has received LIMS login information/card and Iris Scan Access to applicable areas		
3.4.2	Meet with FCU Manager or designee to meet objectives in 3.1.3-3.1.6		
	Receive tour of the Consolidated Forensic Laboratory (CFL) and introduction to disciplines within the Forensic Science Laboratory (FSL).		
	Review relevant job description, organization, and management structure, and receive introduction to the facility and personnel		
	Receive an overview of the Quality Assurance program and receive Qualtrax login information		
3.4.3	Meet with Technical Lead, Manager, or DFS Training Manager to discuss prior experience and educational background		
	The goals of the training program have been explained and understood		
	Trainee has provided management with previous training records and/or previous continuing education certificates		
	Trainee's ITP has been completed and signed		

Additional Notes:

Signatures below represent successful completion of Training Module 3.0.

_____ _____ _____

Trainee/Date Technical Lead/Date Unit Manager/Date

4.0 Quality Assurance Program

4.1 Objectives:

4.1.1 Quality performance, conforming to recognized standards of good practices both in the field and in the laboratory, is the most important goal within the D.C. Department of Forensic Sciences (DFS). As new and improved methods of analyses are developed to meet the expanding needs of the criminal justice and public health systems, it is essential for quality standards to progress in parallel. The DFS is committed to diligently implementing policy and procedure changes to ensure quality in all facets of DFS operations.

4.1.2 The trainee should have an understanding of the quality system to include quality assurance and quality control

4.1.3 The trainee should have an understanding of the purpose of the Qualtrax system, to include:

- 4.1.3.1 Documents stored under the system
- 4.1.3.2 Revision of documents
- 4.1.3.3 Navigation of the system and how to locate documents
- 4.1.3.4 Other functions of the system

4.2 Reading Material

4.2.1 https://www.forensicfocus.com/webinars/quality-management-system-standards-in-forensics-an-executive-overview/

4.2.2 https://what-when-how.com/forensic-sciences/qaqc/

4.2.3 https://www.gossmanforensics.com/newsletter/vol01_iss03.html#:~:text=In%20the%20laboratory%2C%20quality%20assurance,is%20operating%20within%20acceptable%20limits.

4.2.4 https://www.researchgate.net/publication/237287165_Chapter_4_QUALITY_ASSURANCE

4.2.5 https://www.testbytes.net/blog/quality-assurance-vs-quality-control/

4.2.6 Open up the Qualtrax program, locate and read **DOM07** - Practices for Quality Corrective Actions (Document Control Number 1275) and **DOM08** - Procedures for Quality Preventive Actions (Document Control Number 1277).

4.2.7 Open up Qualtrax, find and read the **DFS Quality Policy Statement** (Document Control Number: 4864).

4.3 Study/Discussion Questions:

4.3.1 Define Quality Assurance.

4.3.2 What is a Quality Assurance Program?

4.3.3 Why do laboratories need a Quality Assurance Program?

4.3.4 What is an Audit?

4.3.5 What is the difference between Quality Assurance and Quality Control?

4.3.6 Do you need to log into Qualtrax with your user ID and password to view documents?

4.3.7 What is the purpose of Qualtrax?

4.3.8 What documents can be found on Qualtrax? Which should **only** be stored on Qualtrax and why?

4.3.9 Under DFS there are three (3) Divisions; navigate Qualtrax and determine the names of the Units under the Division you are assigned to.

4.4 Practical Exercises/Skills:

4.4.1 The trainee will receive instruction and demonstration from a member of the Quality unit in the use of Qualtrax, the quality document control system. This may be completed by a series of lectures/presentations and hands-on exercises. Trainee will record notes in training notebook.

4.5 Demonstration of Competency:

4.5.1 None

4.6 Documentation:

4.6.1 Completion of the tasks in this module will be documented on the checklist titled "Module 4.0 Checklist – Quality Assurance Program”.

MODULE 4.0 CHECKLIST
Quality Assurance Program

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
4.2	Complete required readings for Module 4.0		
4.3	Complete Study/Discussion Questions for Module 4.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
4.4.1	Receive instruction and demonstration from a member of the Quality unit in the use of Qualtrax		

Additional Notes:

Signatures below represent successful completion of Training Module 4.0.

_____ _____ _____

Trainee/Date Technical Lead/Date Unit Manager/Date

5.0 Chemical Safety, Chemical Inventory, and Evidence Handling

5.1 Objectives:

5.1.1 Understand importance of protecting yourself and others when handling toxic chemicals and biohazardous substances.

5.1.2 Become familiar with different hazards that may be encountered while in FCU.

5.1.3 Understand proper marking of specimens or samples received in the FCU and proper handling of FCU specimens/samples/evidence (as per Chemist program).

5.1.4 Knowledge of the procedures applied in the collection, receipt, protection, handling, and storage of samples/evidence.

5.1.5 Understand procedures for receipt, storage, and retention of chemicals, reagents, and reference material.

5.2 Reading Material:

5.2.1 FCS03 – SOP for Ordering, Receiving, and Storage of Controlled Dangerous Substances (Document Control # 5918)

5.2.2 FCS05 – SOP for Inventory of the Controlled Dangerous Substances Lab (Document Control #5921)

5.2.3 FCS11 – Procedure for Evidence Receiving, Handling, and Disposition (Document Control #7204)

5.2.4 FCS12 – Controlled Substance Laboratory Policy and Protocols (Document Control #7475)

5.2.5 DOM13 – DFS Health and Safety Manual (Document Control #1617)

5.2.6 FCU Temporary Drug Standard Log (Document Control #30399)

5.2.7 DFS safety data sheets (SDS) for all chemicals in the FCU, as applicable

5.2.8 DFS certificate of analysis (COA) sheets for all chemicals and controlled substances in the FCU, as applicable

5.2.9 DC Hazardous Waste Laws: DC Hazardous Waste Management Act of 1977 (D.C. Law 2-64; D.C. Code § 8-1301 to 8-1322)

5.3 Study/Discussion Questions:

5.3.1 Describe the proper PPE worn while working in the FCU laboratory.

5.3.2 What are the additional PPE (if any) used during chemical activity?

5.3.3 What are the common routes of exposure to infectious diseases?

5.3.4 What types of infectious diseases and/or biological hazards may be encountered while working in the FCU?

5.3.5 When should you change gloves or PPE?

5.3.6 What is the laboratory policy on reporting health and safety incidents?

5.3.7 Discuss potential types of safety hazards you may you encounter in the FCU laboratory?

5.3.8 What is the waste removal process for general lab, biohazard and hazardous wastes?

5.3.9 What are the minimum requirements for a proper seal?

5.3.10 Describe the procedures and practices that are used in the laboratory in order to decrease or prevent the occurrence of sample contamination.

5.3.11 How is evidence received and stored in the FCU? Describe storage before, during, and after casework processing.

5.3.12 How are chemicals stored in the FCU? Where are they located?

5.3.13 How are reference standards stored in the FCU (in-use and not in-use)? Where are they located?

5.3.14 Describe the documentation involved in adding or removing reference standards from the drug vault.

Note: Study/discussion questions may be incorporated into mini oral quiz sessions or a written exam to evaluate the trainee's understanding of topics covered in this module.

5.4 Practical Exercises/Skills:

5.4.1 Review the DFS Safety Training Program and complete Safety Level 1 and Safety Level 2.

5.4.2 Complete FCU Laboratory Safety walk-through, to include, but not limited to, the following:

5.4.2.1 Evacuation process from the facility, including the evacuation routes and meeting place.

5.4.2.2 Locations of fire extinguishers in laboratory, office area, and common areas. Discuss use of fire extinguishers.

5.4.2.3 Provide phone numbers for emergency situations/show the location of phone numbers listed in the laboratory.

5.4.2.4 Locations of First Aid Kits in the laboratory and office areas.

5.4.2.5 Health and safety incident reporting.

5.4.2.6 Location of safety equipment, i.e. safety showers, eye wash stations, PPE, fume hoods.

5.4.2.7 Discuss the proper use of PPE.

5.4.2.8 Location of the Safety Data Sheets (SDS) and Certificates of Analysis (COA).

5.4.2.9 Waste removal process for general lab, biohazard, and hazardous wastes.

5.4.3 Observe qualified individuals requesting/receiving evidence from the Central Evidence Unit (CEU) and understand the procedure, chain of custody documentation/LIMS and evidence examination request forms. Document observations in 30-Day Progress Report. Include name of individual, date, and number of transfers observed. Discuss procedures and policies regarding storage and retention of evidence in FCU as well as consumption of evidence.

5.4.4 Observe qualified chemists examining a variety of types of evidence. Discuss packaging requirements to understand the standards for evidence packaging to include requirements of seals, labels, and package integrity. Take note of the practices used to decrease the occurrence of item/sample contamination.

5.4.5 Observe qualified individuals locate reference material from the drug vault and understand the correct procedure for adding or removing from the inventory.

5.4.6 Participate in a monthly chemical inventory check. Record participation in 30-Day Progress Report.

5.5 Demonstration of Competency:

5.5.1 Successful completion of Safety Level 1 and 2 trainings.

5.5.2 Practical Exercises are successfully completed, results in the form of notes and/or photographs (where applicable) are included in Training

Binder, and the trainer has reviewed for accuracy and meeting the objectives of the exercise(s).

5.6 Documentation:

5.6.1 Completion of the tasks in this module will be documented on the checklist titled "Module 5.0 Checklist – Chemical Safety, Chemical Inventory and Evidence Handling".

MODULE 5.0 CHECKLIST
Chemical Safety, Chemical Inventory, and Evidence Handling

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
5.2	Complete required readings for Module 5.0		
5.3	Complete Study/Discussion Questions for Module 5.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
5.4.1	Complete Safety Level 1 and Safety Level 2 Trainings		
5.4.2	Complete FCU Laboratory safety walk-through		
5.4.3	Observe requesting/receiving/storage of evidence from CEU		
5.4.4	Observe examination of evidence and packaging		
5.4.5	Observe adding/removing reference material from the drug vault and documentation		
5.4.6	Participate in chemical inventory check		
DEMONSTRATION OF COMPETENCY			
		Trainee Initials & Date	**Trainer Initials & Date**
5.5.1	Trainee has successfully passed Safety Level 1 and 2 Trainings		

Additional Notes:

Signatures below represent successful completion of Training Module 5.0.

_____ _____ _____

Trainee/Date Technical Lead/Date Unit Manager/Date

6.0 Procedures Overview

6.1 Objectives:

6.1.1 Knowledge of the procedures applied in the analysis of samples/evidence, as well as documentation, evaluation, report writing and communication of results.

6.1.2 Ability to choose the best-case approach, preparation of samples and handling of evidence, implementation of analytical schemes and methodology, and reporting of results, for each individual case.

6.1.3 Ability to interpret and handle analytical data and related information so as to create and use respective databases.

6.1.4 Understanding of related general FCU procedures including, but not limited to, the following topics:

- 6.1.4.1 Case approach
- 6.1.4.2 General analytical schemes for unknown samples / powders / tablets / capsules / herbal material
- 6.1.4.3 Weighing practices
- 6.1.4.4 Sampling practices
- 6.1.4.5 Choice of analytical methodology
- 6.1.4.6 Validation/verification of methods
- 6.1.4.7 Application of techniques per substance(s)
- 6.1.4.8 Development of SOPs
- 6.1.4.9 Equipment performance and control, preventive maintenance
- 6.1.4.10 Quality control
- 6.1.4.11 Interpretation and reporting of the results
- 6.1.4.12 Documents and case records
- 6.1.4.13 Handling/storage of samples/evidentiary material
- 6.1.4.14 Handling and removing evidence from various containers/packaging (avoid hard-surface contact to dislodge contents)
- 6.1.4.15 Handling/storage of information, access to databases
- 6.1.4.16 Chain of custody
- 6.1.4.17 Communication with clients (including communication language, establishing needs, dealing with undue pressure, etc.)

6.2 Reading Material:

6.2.1 LOM01 – Procedures for the Examination of Evidence (Document Control #1315)

6.2.2 FSL QAM (Document Control #10164)

6.2.3 FCS01 – SOP for Detecting Controlled Dangerous Substances (Document Control #4376)

6.2.4 FCS02 – SOP for General Laboratory Procedures for FCU (Document Control #5917)

6.2.5 "Basic Training Program for Forensic Drug Chemists" United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences, if available

6.2.6 ASTM E2326-14 Standard Practice for Education and Training of Seized-Drug Analysts

6.3 Study/Discussion Questions:

6.3.1 Outline a general FCU process scheme starting from a request for analysis to reporting and returning of evidence.

6.3.2 List and define common specifications evaluated for method validations.

6.3.3 Explain the difference between critical and non-critical equipment. List examples of each.

6.3.4 Explain how instrument and equipment performance is monitored (general explanation).

6.3.5 Describe the differences between performance verifications, performance checks, and validations.

6.3.6 Describe the requirements for labeling and documenting an item of evidence that is repackaged after analysis.

6.4 Practical Exercises/Skills:

6.4.1 Observe qualified chemist(s) process at least three cases. Note the workflow and procedures taken from start to finish (chain of custody, case approach, sampling plan, instrument choice, interpretation of results, repackaging, and re-sealing). Discuss the case approach and note how the chemist removed contents from the original container. Record the following on the 30-Day Progress report: case number, qualified chemist(s) observed, and date of observation.

6.4.2 Demonstrate understanding of procedural overview by developing a case approach for the following:

6.4.2.1 Two vials of suspected PCP liquid
6.4.2.2 Three round pink pills
6.4.2.3 500 rectangular pills marked “XANAX”
6.4.2.4 250 blue ziplock plastic bags each containing white rock-like substance.

Note: Throughout the training program, the trainee is expected to gather case notes and reports of chemists to use as examples for learning how to take case notes and write reports of their own. Reviews and any questions regarding developing casework documentation should be discussed with trainer(s). As trainees progress through training, their knowledge and ability to work independently with case notes, report writing and conducting reviews should increase.

6.5 Demonstration of Competency:

6.5.1 Practical Exercises are successfully completed, results in the form of notes and/or photographs (where applicable) are included in training binder, and the trainer has reviewed for accuracy and meeting the objectives of the exercise(s). The trainer(s) may also sign off on the module by oral discussion/proof of understanding of the material by the trainee.

6.6 Documentation:

6.6.1 Completion of the tasks in this module will be documented on the checklist titled "Module 6.0 Checklist – Procedures Overview."

MODULE 6.0 CHECKLIST
Procedures Overview

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
6.2	Complete required readings for Module 6.0		
6.3	Complete Study/Discussion Questions for Module 6.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
6.4.1	Observe processing of cases from start to finish		
	Case #:		
	Case #:		
	Case #:		
6.4.2	Develop case approach for listed examples		

Additional Notes:

Signatures below represent successful completion of Training Module 6.0.

Trainee/Date	Technical Lead/Date	Unit Manager/Date

7.0 Analytical Techniques – Balances

7.1 Objectives:

7.1.1 Familiarity of the operation of a balance.

7.1.2 Familiarity of balance calibration and quality assurance practices.

7.1.3 Familiarity of measurement uncertainty.

- 7.1.3.1 Random vs. Systematic error
- 7.1.3.2 Expanded Uncertainty
- 7.1.3.3 Sources of error in a balance, e.g., person, instrument
- 7.1.3.4 Precision vs. Accuracy

7.1.4 Proper handling of weights (gloves).

7.1.5 Understanding of related FCU procedures including, but not limited to, the following topics:

- 7.1.5.1 Recording and reporting weights and volumes
- 7.1.5.2 Types of weights used in FCU (gross, package, and net)
- 7.1.5.3 Maintenance and calibration procedures (weekly and annual)
- 7.1.5.4 Weight calibration
- 7.1.5.5 Calculation of balance uncertainty

7.2 Reading Material:

7.2.1 Balance instruction manuals (various vendors)

7.2.2 FCS01 – SOP for Detecting Controlled Dangerous Substances (Document Control #4376)

7.2.3 FCS02 – SOP for General Laboratory Procedures for FCU (Document Control #5917)

7.2.4 FCS07 – SOP for Operating and Maintaining Balances (Document Control #6052)

7.2.5 FCS21 – Procedure for Uncertainty in Measurement (Document Control #10141)

7.2.6 FCU Measurement Uncertainty Estimation Form (Document Control #35233)

7.3 Study/Discussion Questions:

7.3.1 What are balances used for in the lab?

7.3.2 What PPE is required to operate a balance? Why are gloves important?

7.3.3 What does it mean to 'tare' and 'zero' a balance?

7.3.4 What kind of maintenance is performed on the balances (Weekly, monthly, annually)? What is the calibration schedule for balances and standard weights?

7.3.5 How and where are maintenance records stored?

7.3.6 Define uncertainty. How is uncertainty calculated in the lab? Which k value is used?

7.3.7 What does it mean to have a 95% confidence level vs a 99% confidence level?

7.3.8 What is random error vs. systemic error? Can you provide examples?

7.3.9 Define gross weight, package weight, and net weight.

7.3.10 Explain how to weigh a package of drug evidence; include gross/net and post analysis weight practices.

Note: Study/discussion questions may be incorporated into mini oral quiz sessions or a written exam to evaluate the trainee's understanding of topics covered in this module.

7.4 Practical Exercises/Skills:

7.4.1 Observe qualified chemist(s) perform weekly and/or monthly balance maintenance. Note the PPE used to perform maintenance. Note the procedures for handling and weighing an item of evidence. Note location of serial numbers and expiration dates of calibrated weights used for maintenance.

7.4.2 Demonstrate understanding of weekly maintenance by participating in maintenance with supervision. Record dates in training binder. Trainer must observe trainees perform balance maintenance at least once.

7.4.3 Independently perform weekly balance maintenance (at least twice). Record dates in training binder.

7.5 Demonstration of Competency:

7.5.1 Practical Exercises are successfully completed, results in the form of notes and/or photographs (where applicable) are included in training binder, and the trainer has reviewed for accuracy and meeting the objectives of the exercise(s). The trainer(s) may also sign off on the module by oral discussion/proof of understanding of the material by the trainee.

7.5.2 The Trainee must successfully complete an oral board, addressing in detail all topics outlined in the Objectives.

7.6 Documentation:

7.6.1 Completion of the tasks in this module will be documented on the checklist titled "Module 7.0 Checklist –Analytical Techniques – Balances."

MODULE 7.0 CHECKLIST
Analytical Techniques - Balances

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
7.2	Complete required readings for Module 7.0		
7.3	Complete Study/Discussion Questions for Module 7.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
7.4.1	Observe performance of weekly maintenance		
7.4.2	Perform weekly maintenance under supervision		
7.4.3	Independently perform weekly maintenance		
	Day 1:		
	Day 2:		
DEMONSTRATION OF COMPETENCY			
		Trainee Initials & Date	**Trainer Initials & Date**
7.5.2	Trainee successfully completed and passed an Oral Board for Module 7.0		

Additional Notes:

Signatures below represent successful completion of Training Module 7.0.

_____ _____ _____

Trainee/Date Technical Lead/Date Unit Manager/Date

8.0 Analytical Techniques – Sampling Plan

8.1 Objectives:

8.1.1 Familiarity with the concept of sampling

8.1.2 Understanding of the difference between statistical and non-statistical sampling plans

8.1.3 Understanding of related FCU procedures including, but not limited to, the following topics:

8.1.3.1 Types of sampling plans used in FCU (administrative, hypergeometric, percent-based)
8.1.3.2 Case approach for each type of sampling plan
8.1.3.3 Case approach for syringes and/or residues
8.1.3.4 Case approach for multiple populations and other considerations, such as weight thresholds and composites

8.2 Reading Material:

8.2.1 FCS01 – SOP for Detecting Controlled Dangerous Substances (Document Control #4376)

8.2.2 FCS02 – SOP for General Laboratory Procedures for FCU (Document Control #5917)

8.2.3 UNODC. ”Guidelines on Representative Drug Sampling,” United Nations (2009).

8.2.4 Head, Jill. “Sampling Approaches to Synthetic Drug Seizures,” Drug Enforcement Administration.

8.3 Study/Discussion Questions:

8.3.1 What is the purpose of a sampling plan?

8.3.2 What are the limitations of sampling plans?

8.3.3 What is an administrative sampling plan? Why/When is it used?

8.3.4 What is a hypergeometric sampling plan? Why/When is it used?

8.3.5 What is a percent-based sampling plan? Why/When is it used?

8.3.6 What is a residue?

8.3.7 What is a composite?

Note: Study/discussion questions may be incorporated into mini oral quiz sessions or a written exam to evaluate the trainee's understanding of topics covered in this module.

8.4 Practical Exercises/Skills:

8.4.1 Observe qualified chemist(s) perform sampling plans using the methods outlined in the Forensic Chemistry Unit Standard Operating Procedures (FCU SOPs) on a minimum of 5 cases. Observe and review casework note-taking and documentation. Record the following on the 30-Day Progress report: case number, qualified chemist(s) observed, date of observation, and type of sampling plan.

8.4.2 Demonstrate understanding of sampling plans to the trainer by developing sampling plans for the following:

8.4.2.1 Develop a sampling plan for a cupcake.
8.4.2.2 Develop a sampling plan for a bag of pills (same imprint).
8.4.2.3 Develop a sampling plan for a bag of pills (different imprints).
8.4.2.4 Develop a sampling plan for a bag of plant material.
8.4.2.5 Develop a sampling plan for a box of 1,000 packages of suspected synthetic cannabinoids.

8.5 Demonstration of Competency:

8.5.1 Practical Exercises are successfully completed, results in the form of notes and/or photographs (where applicable) are included in training binder, and the trainer has reviewed for accuracy and meeting the objectives of the exercise(s). The trainer(s) may also sign off on the module by oral discussion/proof of understanding of the material by the trainee.

8.5.2 The Trainee must successfully complete an oral board, addressing in detail all topics outlined in the Objectives.

8.6 Documentation:

8.6.1 Completion of the tasks in this module will be documented on the checklist titled "Module 8.0 Checklist –Analytical Techniques – Sample Extraction."

MODULE 8.0 CHECKLIST
Analytical Techniques – Sampling Plan

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
8.2	Complete required readings for Module 8.0		
8.3	Complete Study/Discussion Questions for Module 8.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
8.4.1	Observe sampling procedures in casework samples		
	Case #:		
	Case #:		
	Case #:		
	Case #:		
	Case #:		
8.4.2	Develop a sampling plan for the listed examples		
DEMONSTRATION OF COMPETENCY			
		Trainee Initials & Date	**Trainer Initials & Date**
8.5.2	Trainee successfully completed and passed an Oral Board for Module 8.0		

Additional Notes:

Signatures below represent successful completion of Training Module 8.0.

_____	_____	_____
Trainee/Date	Technical Lead/Date	Unit Manager/Date

9.0 Analytical Techniques – Sample Extraction

9.1 Objectives:

9.1.1 Knowledge of the principle / theory of separations and extractions in drug analysis:

- 9.1.1.1 Awareness of the factors which affect separations (solubility)
- 9.1.1.2 Knowledge of the criteria for selection of solvent systems, including safety and cost

9.1.2 Familiarity with extraction techniques (basic, acidic, amphoteric, neutral drug extractions using aqueous/organic solvents)

9.1.3 Awareness of possible problems and likely causes/solutions.

9.1.4 Use of solubility to separate mixtures of drugs and diluents.

9.1.5 Definition of pKa and the Henderson-Hasselbach equation.

9.1.6 Specialty (difficult) type extractions.

9.1.7 Knowledge of the application of Solid Phase extraction (SPE) in drug analysis.

9.1.8 Knowledge of chromatographic separation techniques:

- 9.1.8.1 Use of preparative column
- 9.1.8.2 Use of Silica and Flurosil columns, among others
- 9.1.8.3 Column preparation, loading and eluting

9.1.9 Understanding of related FCU procedures including, but not limited to, the following topics:

- 9.1.9.1 Solvents used for simple extractions of various types of drugs
- 9.1.9.2 Basified solvent extractions
- 9.1.9.3 Extractions for purifying drug mixtures

9.2 Reading Material:

9.2.1 FCS01 – SOP for Detecting Controlled Dangerous Substances (Document Control #4376)

9.3 Study/Discussion Questions:

9.3.1 Define: solubility, diluent, pKa

9.3.2 What is a liquid-liquid extraction? Solid-phase extraction?

9.3.3 What is the Henderson-Hasselbach equation? What is this equation used for?

9.3.4 What is a “basic” drug? Provide an example.

9.3.5 What is an “acidic” drug? Provide an example.

9.3.6 What is an “amphoteric” drug? Provide an example.

9.3.7 List which solvent or extraction procedure you would use for the following substances (for GC-MS/GC-FID):

- 9.3.7.1 Tan powder
- 9.3.7.2 White crystalline powder (suspected methamphetamine)
- 9.3.7.3 Off-white crystalline rock/powder (suspected synthetic cathinone)
- 9.3.7.4 Green-brown plant material (suspected marijuana)
- 9.3.7.5 Suspected synthetic cannabinoid plant material
- 9.3.7.6 Oxycodone/Acetaminophen prescription pill
- 9.3.7.7 Sublingual strip
- 9.3.7.8 Blotter paper
- 9.3.7.9 Mushroom plant material
- 9.3.7.10 Vape cartridge
- 9.3.7.11 Cigarette
- 9.3.7.12 Cough syrup
- 9.3.7.13 Suspected PCP liquid
- 9.3.7.14 Suspected GHB liquid
- 9.3.7.15 Unknown liquid

9.3.8 List which solvent or extraction procedure you would use for the following (for FT-IR):

- 9.3.8.1 Cocaine base with levamisole
- 9.3.8.2 Cocaine base with phenacetin
- 9.3.8.3 Cocaine hydrochloride with phenacetin
- 9.3.8.4 Cocaine hydrochloride with mannitol

Note: Study/discussion questions may be incorporated into mini oral quiz sessions or a written exam to evaluate the trainee’s understanding of topics covered in this module.

9.4 Practical Exercises/Skills:

9.4.1 Observe qualified chemist(s) perform the following extractions. Observe and review casework note-taking and documentation. Record the following on the 30-Day Progress report: case number (if applicable), qualified chemist(s) observed, date of observation, and type of extraction performed.

- 9.4.1.1 Ammoniacal Chloroform or Ammoniacal 9:1 Chloroform:Methanol
- 9.4.1.2 Sodium Carbonate
- 9.4.1.3 Petroleum ether
- 9.4.1.4 Water and hexanes
- 9.4.1.5 Acetone and chloroform

9.4.2 Demonstrate understanding to the trainer by independently performing the following extractions on training samples. Document the type of sample and extractions used on the 30-Day Progress Report form. Trainer must observe trainees perform chemical extractions at least once. Each training sample should be reviewed by the trainer. Note: Extractions performed in another module's training case may also fulfill these requirements.

- 9.4.2.1 Ammoniacal Chloroform or Ammoniacal 9:1 Chloroform:Methanol
- 9.4.2.2 Sodium Carbonate
- 9.4.2.3 Petroleum ether
- 9.4.2.4 Water and hexanes
- 9.4.2.5 Acetone and chloroform

9.5 Demonstration of Competency:

9.5.1 Practical Exercises are successfully completed, results in the form of notes and/or photographs (where applicable) are included in training binder, and the trainer has reviewed for accuracy and meeting the objectives of the exercise(s). The trainer(s) may also sign off on the module by oral discussion/proof of understanding of the material by the trainee.

9.5.2 Oral Board – Analytical Techniques: The Trainee must successfully complete an oral board, addressing in detail all topics outlined in the Objectives.

9.6 Documentation:

9.6.1 Completion of the tasks in this module will be documented on the checklist titled "Module 9.0 Checklist –Analytical Techniques – Sample Extraction."

MODULE 9.0 CHECKLIST
Analytical Techniques – Sample Extraction

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
9.2	Complete required readings for Module 9.0		
9.3	Complete Study/Discussion Questions for Module 9.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
9.4.1	Observe qualified chemists perform extractions		
	Ammoniacal Chloroform or Ammoniacal 9:1/Case #:		
	Sodium Carbonate/Case #:		
	Petroleum Ether/Case #:		
	Water and hexanes/Case #:		
	Acetone and Chloroform/Case #:		
9.4.2	Independently perform extractions		
	Ammoniacal Chloroform or Ammoniacal 9:1/Case #:		
	Sodium Carbonate/Case #:		
	Petroleum Ether/Case #:		
	Water and hexanes/Case #:		
	Acetone and Chloroform/Case #:		
DEMONSTRATION OF COMPETENCY			
		Trainee Initials & Date	**Trainer Initials & Date**
9.5.2	Trainee successfully completed and passed an Oral Board for Module 9.0		

Additional Notes:

Signatures below represent successful completion of Training Module 9.0.

_____ _____ _____

Trainee/Date Technical Lead/Date Unit Manager/Date

10.0 Presumptive Tests – Color ("Spot") Tests and Pharmaceutical Identification

10.1 Objectives:

10.1.1 Knowledge of the principle / theory of color tests.

10.1.2 Ability to execute color tests on drugs most commonly encountered in the illicit drug market.

10.1.3 Knowledge of the possibilities and limitations of the technique.

10.1.4 Understanding of related FCU procedures including, but not limited to, the following topics:

- 10.1.4.1 Reagents currently validated for use in FCU
- 10.1.4.2 Procedure for performing each color test
- 10.1.4.3 Interpretation of results
- 10.1.4.4 Preparation of reagents
- 10.1.4.5 Quality control procedures for prepared reagents

10.1.5 Familiarity of pharmaceutical pill markings (shape, color, score, imprint).

10.1.6 Familiarity with identification of pharmaceutical pills/tablets.

10.1.7 Ability to interpret the results obtained from physical identification.

10.1.8 Knowledge of the possibilities and limitations of the technique.

10.1.9 Understanding of how to perform pharmaceutical identification of pills through FCU approved resources.

10.2 Reading Material:

10.2.1 FCS01 – SOP for Detecting Controlled Dangerous Substances (Document Control #4376)

10.2.2 FCS02 – SOP for General Laboratory Procedures for FCU (Document Control #5917)

10.2.3 FCS10 – SOP for Chemical Spot Tests (Document Control #7474)

10.2.4 Validation of FCU10 – Procedure for Chemical Spot Tests

10.2.5 Validation of Mayer's Test Reagent (Under FCS10)

10.2.6 "Rapid Testing Methods of Drugs of Abuse". UNODC. ST/NAR/13/Rev. I. Feb.1995

10.2.7 "Clarke's Analysis of Drugs and Poisons", A. C. Moffat, M. D. Osselton and B. Widdop (eds.) (2004), 3rd ed., Pharmaceutical Press, London-Chicago

10.2.8 As applicable for pharmaceutical identification:

10.2.8.1 Drug Identification Bible (2011 edition or later)
10.2.8.2 WebPoison Control (https://pill-id.webpoisoncontrol.org)
10.2.8.3 Drugs.com
10.2.8.4 Clarke's Analysis of Drugs and Poisons (Fourth edition or later)

10.3 Study/Discussion Questions:

10.3.1 What is the purpose of chemical spot tests?

10.3.2 What are the limitations of chemical spot tests?

10.3.3 What is a negative control?

10.3.4 What is a positive control?

10.3.5 What is the difference between presumptive and confirmatory analytical techniques?

10.3.6 Which color test reagents are currently validated in the FCU?

10.3.7 How do we make/test each reagent? How often are reagents retested?

10.3.8 Please document/describe the naming scheme used for reagents made in FCU.

10.3.9 Which resources are available for pharmaceutically identifying a pill/tablet within the FCU?

10.3.10 How would you document a pharmaceutical identification result without a photo (Worksheet, Case Report)? How would you document a pharmaceutical identification that does not match your analytical results?

10.3.11 What is a score?

10.3.12 Define the following terms: capsule, tablet, extended release, soft gel, OTC

Note: Study/discussion questions may be incorporated into mini oral quiz sessions or a written exam to evaluate the trainee's understanding of topics covered in this module. It is the discretion of the trainee to answer questions for their training binder.

10.4 Practical Exercises/Skills:

10.4.1 Observe qualified chemist(s) prepare color test reagents used for casework. Note the procedure for making/testing the reagent and quality controls in place to document the reagent. Note the information that is recorded (lot numbers, preparer, expiration dates). Discuss limitations of color tests with trainer. Document examples or situations that may occur.

10.4.2 Independently prepare a color test reagent according to FCU SOPs with supervision. Document date of participation in training binder.

10.4.3 Independently test or re-test a color test reagent according to FCU SOPs with supervision. Document date of participation in training binder.

10.4.4 Independently perform a color test for each validated color test in FCU. Observe and note the observed color changes in your training binder.

10.4.5 Observe qualified chemist(s) pharmaceutically identify pills for casework on at least two casework samples. Observe and review casework note-taking and documentation. Record the following on the 30-Day Progress report: case number, qualified chemist(s) observed, date of observation, and type of extraction performed.

10.4.6 Document the presumptive pharmaceutical identification for the following items using FCU SOP approved resources:

10.4.6.1 White, Round, 512
10.4.6.2 M, 30, Blue
10.4.6.3 10 325, RP
10.4.6.4 54, 425
10.4.6.5 Orange, P, 2
10.4.6.6 A, 1 6
10.4.6.7 White, rectangle
10.4.6.8 Pentagon, 0.5
10.4.6.9 Orange, Capsule, XR
10.4.6.10 93 150, 3
10.4.6.11 Blue, ABG, 15
10.4.6.12 DAN, 5513
10.4.6.13 Red, KALI, 083

10.4.6.14 M, C, 13
10.4.6.15 Yellow, Round, TEVA
10.4.6.16 DAM, 5620, 10, Blue, One Score, Round

10.4.7 Demonstrate understanding of pharmaceutical identifications to the trainer by submitting at least one practice case that includes physical identification results. Document practice case packet and feedback in training binder.

10.5 Demonstration of Competency:

10.5.1 Practical Exercises are successfully completed, results in the form of notes and/or photographs (where applicable) are included in training binder, and the trainer has reviewed for accuracy and meeting the objectives of the exercise(s). The trainer(s) may also sign off on the module by oral discussion/proof of understanding of the material by the trainee.

10.5.2 Oral Board – Presumptive Tests- Color ("Spot") Tests and Pharmaceutical Identification. The Trainee must successfully complete an oral board, addressing in detail all topics outlined in the Objectives.

10.6 Documentation:

10.6.1 Completion of the tasks in this module will be documented on the checklist titled "Module 10.0 Checklist – Presumptive Tests – Color (“Spot”) Tests and Pharmaceutical Identification."

MODULE 10.0 CHECKLIST
Presumptive Tests – Color ("Spot") Tests and Pharmaceutical Identification

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
10.2	Complete required readings for Module 10.0		
10.3	Complete Study/Discussion Questions for Module 10.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
10.4.1	Observe preparation of color test reagent(s)		
10.4.2	Independently prepare a color test reagent		
10.4.3	Independently test or re-test a color test reagent		
10.4.4	Independently perform a color test for each validated color test in FCU		
10.4.5	Observe pharmaceutical identification in casework samples		
	Case #:		
	Case #:		
10.4.6	Document presumptive pharmaceutical identifications for listed examples		
10.4.7	Submit a training case that includes a pharmaceutical identification		
	Case #:		
DEMONSTRATION OF COMPETENCY			
		Trainee Initials & Date	**Trainer Initials & Date**
10.5.2	Trainee successfully completed and passed an Oral Board for Module 10.0		

Additional Notes:

Signatures below represent successful completion of Training Module 10.0.

_____ _____ _____

Trainee/Date Technical Lead/Date Unit Manager/Date

11.0 Gas Chromatography (GC) including Gas Chromatography / Mass Spectrometry (GC-MS) and coupled with Gas Chromatography / Flame Ionization Detection (GC-FID)

11.1 Objectives:

11.1.1 Knowledge of the principle/theory of Gas Chromatography (including GC-MS) in drug analysis:

- 11.1.1.1 Awareness of the mechanism of separations, including support materials, stationary phases, carrier gas and operating temperature, and relevant criteria.
- 11.1.1.2 Familiarity with the various instrumental components and their functions, including injection port, column, and detectors (FID, MS).
- 11.1.1.3 Familiarity with the MS components and their functions, including sample inlet, ionization, ion separation, ion detection and amplification, output of results.
- 11.1.1.4 Knowledge of the theory and mechanism of GC-MS as an identification technique, fragmentation process and spectra interpretation.
- 11.1.1.5 Knowledge of derivatization techniques, advantages, and disadvantages.
- 11.1.1.6 Knowledge of qualitative and quantitative determinations using GC.
- 11.1.1.7 Awareness of common operational problems and causes, pitfalls and troubleshooting, preventive maintenance.
- 11.1.1.8 Knowledge of concept of quality assurance and method validation.

11.1.2 Ability in the application of GC and GC-MS in drug analysis:

- 11.1.2.1 Ability to prepare samples and avoid cross contamination
- 11.1.2.2 Familiarity with/practice in the GC instrumentation and software.
- 11.1.2.3 Familiarity with/practice in the GC-MS instrumentation and software.
- 11.1.2.4 Familiarity with the operational procedures, including control of instrument.
- 11.1.2.5 Knowledge of choice criteria and ability to determine suitable conditions and to design experiments aiming at optimum separations

11.1.2.6 Practice in the application of GC and GC-MS methodology for qualitative and quantitative analysis of drugs most commonly encountered.

11.1.3 Understanding the possibilities and limitations of the technique.

11.1.4 Understanding of related FCU procedures including, but not limited to, the following topics:

11.1.4.1 Weekly maintenance procedures
11.1.4.2 Monthly maintenance procedures
11.1.4.3 Annual preventative maintenance procedures/scheduling
11.1.4.4 General instrument troubleshooting
11.1.4.5 Validated methods used in FCU
11.1.4.6 Quality assurance procedures
11.1.4.7 Acceptance criteria for detecting controlled dangerous substances (CDS)
11.1.4.8 Available libraries for screening compounds

11.2 Reading Material:

11.2.1 FCS01 – SOP for Detecting Controlled Dangerous Substances (Document Control #4376)

11.2.2 FCS02 – SOP for General Laboratory Procedures for FCU (Document Control #5917)

11.2.3 FCS09 – SOP for Operating and Maintaining GC-MS and GC-FID Instruments (Document Control #7291)

11.2.4 Thet, K., Woo, N. “Gas Chromatography.” LibreTexts UC Davis, 2020.

11.3 Study/Discussion Questions:

11.3.1 What is the principle of GC?

11.3.2 What is the principle of MS?

11.3.3 How are ions made in GC-MS?

11.3.4 How is fragmentation in GC-MS useful?

11.3.5 What is the principle of FID?

11.3.6 List all validated GC-MS and GC-FID FCU methods and list which instruments they are available on.

11.3.7 Outline the weekly, monthly, and annual maintenance procedures for GC-MS and GC-FID.

11.3.8 What libraries are used in FCU for MS searching?

Note: Study/discussion questions may be incorporated into mini oral quiz sessions or a written exam to evaluate the trainee's understanding of topics covered in this module. It is the discretion of the trainee to answer questions for their training binder.

11.4 Practical Exercises/Skills:

11.4.1 Observe qualified chemist(s) perform the following maintenance on GC-MS and GC-FIDs. Note PPE used and steps followed to prevent contamination. Record date of observation in training binder.

11.4.1.1 Weekly maintenance GC-MS
11.4.1.2 Weekly maintenance GC-FID
11.4.1.3 Monthly maintenance GC-MS or GC-FID

11.4.2 Demonstrate the following maintenance under supervision by a trainer, using methods outlined in FCU SOPs. Record instrument status and information in the appropriate logbooks and control charts. *NOTE: Must be completed prior to trainee proceeding to independent exercises.

11.4.2.1 Weekly maintenance GC-MS
11.4.2.2 Weekly maintenance GC-FID
11.4.2.3 Monthly maintenance GC-MS or GC-FID

11.4.3 Independently perform the following maintenance using methods outlined in FCU SOPs. Record instrument status and information in the appropriate logbooks and control charts. Document participation in training binder.

11.4.3.1 Weekly maintenance GC-MS
11.4.3.2 Weekly maintenance GC-FID
11.4.3.3 Monthly maintenance GC-MS or GC-FID

11.4.4 Demonstrate understanding of GC-MS and GC-FID to the trainer by submitting at least two training case samples for each method performing the identification of a controlled substance using validated FCU procedures. Document practice case packets (if applicable) and feedback in training binder.

11.5 Demonstration of Competency:

11.5.1 Practical Exercises are successfully completed, results in the form of notes and/or photographs (where applicable) are included in training binder, and the trainer has reviewed for accuracy and meeting the objectives of the exercise(s). The trainer(s) may also sign off on the module by oral discussion/proof of understanding of the material by the trainee.

11.5.2 Oral Board – Gas Chromatography (GC) including Gas Chromatography / Mass Spectrometry (GC-MS) and Gas Chromatography / Flame Ionization Detection (GC-FID). The trainee must successfully complete an oral board, addressing in detail all topics outlined in the Objectives.

11.6 Documentation:

11.6.1 Completion of the tasks in this module will be documented on the checklist titled "Module 11.0 Checklist – Gas Chromatography (GC) including Gas Chromatography / Mass Spectrometry (GC-MS) and coupled with Gas Chromatography / Flame Ionization Detection (GC-FID)."

MODULE 11.0 CHECKLIST

Gas Chromatography (GC) including Gas Chromatography / Mass Spectrometry (GC-MS) and coupled with Gas Chromatography / Flame Ionization Detection (GC-FID)

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
11.2	Complete required readings for Module 11.0		
11.3	Complete Study/Discussion Questions for Module 11.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
11.4.1	Observe GC-MS and GC-FID maintenance		
	Weekly maintenance GC-MS		
	Weekly maintenance GC-FID		
	Monthly maintenance GC-MS or GC-FID		
11.4.2	Perform supervised GC-MS and GC-FID maintenance		
	Weekly maintenance GC-MS		
	Weekly maintenance GC-FID		
	Monthly maintenance GC-MS or GC-FID		
11.4.3	Independently perform GC-MS and GC-FID maintenance		
	Weekly maintenance GC-MS		
	Weekly maintenance GC-FID		
	Monthly maintenance GC-MS or GC-FID		
11.4.4	Submit two training case samples (for each method) involving GC-MS and GC-FID analysis		
	GC-MS Case #:		
	GC-MS Case #:		
	GC-FID Case #:		
	GC-FID Case #:		
DEMONSTRATION OF COMPETENCY			
		Trainee Initials & Date	**Trainer Initials & Date**
11.5.2	Trainee successfully completed and passed an Oral Board for Module 11.0		

Additional Notes:

Signatures below represent successful completion of Training Module 11.0.

_____	_____	_____
Trainee/Date	Technical Lead/Date	Unit Manager/Date

12.0 High Performance Liquid Chromatography (HPLC) including Liquid Chromatography Mass Spectrometry (LC-MS)

12.1 Objectives:

12.1.1 Knowledge of the principle/theory of HPLC and LC-MS in drug analysis:

- 12.1.1.1 Knowledge of the mechanism of separations, including stationary phases (columns, criteria of choice), mobile phase (types, uses, composition) and temperature.
- 12.1.1.2 Familiarity with the various instrumental components and their functions including injections port, column and detector (DAD, MS).
- 12.1.1.3 Familiarity with the MS components and their functions, including sample inlet, ionization, ion separation, ion detection and amplification, output of results.
- 12.1.1.4 Awareness of the mechanism of HPLC incl. LC-MS as an identification technique.
- 12.1.1.5 Ionization and fragmentation of LC-MS, mass spectrum interpretation
- 12.1.1.6 Qualitative and quantitative determinations using HPLC and LC-MS.
- 12.1.1.7 Awareness of common operational problems and causes, pitfalls and troubleshooting, preventive maintenance.

12.1.2 Knowledge of the application of HPLC and LC-MS in drug analysis:

- 12.1.2.1 Familiarity with the HPLC and LC-MS instrumentation and software.
- 12.1.2.2 Familiarity with the operational procedures including control of instrument.
- 12.1.2.3 Ability to design experiments aiming at selecting operating conditions for optimum separations.
- 12.1.2.4 Practice in the application of HPLC and LC-MS methodology in the qualitative and quantitative analysis of drugs most commonly encountered.

12.1.3 Capacity of interpretation of the results obtained.

12.1.4 Understanding of related FCU procedures, including, but not limited to, the following topics:

- 12.1.4.1 Weekly maintenance procedures
- 12.1.4.2 Monthly maintenance procedures
- 12.1.4.3 Annual preventative maintenance procedures/scheduling

12.1.4.4 General instrument troubleshooting
12.1.4.5 Validated methods used in FCU
12.1.4.6 Quality assurance procedures
12.1.4.7 Acceptance criteria for detecting CDS
12.1.4.8 Available libraries for screening compounds

12.2 Reading Material:

12.2.1 FCS01 – SOP for Detecting Controlled Dangerous Substances (Document Control #4376)

12.2.2 FCS02 - SOP for General Laboratory Procedures for FCU (Document Control #5917)

12.2.3 Raja, P.M.V., Barron, A.R. “High Performance Liquid Chromatography.” Rice University, 2022.

12.2.4 “What is HPLC (High Performance Liquid Chromatography)?” (Shimadzu)

12.3 Study/Discussion Questions:

12.3.1 What is the principle of LC?

12.3.2 What is the principle of MS?

12.3.3 How are ions made in LC-MS?

12.3.4 How is fragmentation or adduct formation in LC-MS useful?

12.3.5 What are typical solvents used?

12.3.6 How is a solvent gradient important?

Note: Study/discussion questions may be incorporated into mini oral quiz sessions or a written exam to evaluate the trainee’s understanding of topics covered in this module. It is the discretion of the trainee to answer questions for their training binder.

12.4 Practical Exercises/Skills:

12.4.1 Observe qualified chemist(s) perform weekly and monthly maintenance on LC-MS. Note PPE used and steps followed to prevent contamination. Record date of observation in training binder.

12.4.2 Demonstrate LC-MS understanding by performing the following maintenance. Record instrument status in the appropriate logbooks and control charts. Trainer must observe trainee perform the weekly and

monthly maintenance at least once, prior to trainee proceeding to independent exercises.

12.4.2.1 Weekly maintenance LC-MS
12.4.2.2 Monthly maintenance LC-MS

12.4.3 Independently perform weekly and monthly LC-MS maintenance. Use methods outlined in the FCU SOPs. Document participation in training binder.

12.4.4 Demonstrate understanding of LC-MS and to the trainer by submitting at least two training case samples performing the identification of a controlled substance using LC-MS validated FCU procedures. Document practice case packets (if applicable) and feedback in training binder.

12.5 Demonstration of Competency:

12.5.1 Practical Exercises are successfully completed, results in the form of notes and/or photographs (where applicable) are included in training binder, and the trainer has reviewed for accuracy and meeting the objectives of the exercise(s). The trainer(s) may also sign off on the module by oral discussion/proof of understanding of the material by the trainee.

12.5.2 Oral Board – High Performance Liquid Chromatography (HPLC) including Liquid Chromatography Mass Spectrometry (LC-MS). The trainee must successfully complete an oral board, addressing in detail all topics outlined in the Objectives.

12.6 Documentation:

12.6.1 Completion of the tasks in this module will be documented on the checklist titled "Module 12.0 Checklist – High Performance Liquid Chromatography (HPLC) including Liquid Chromatography Mass Spectrometry (LC-MS)."

MODULE 12.0 CHECKLIST
High Performance Liquid Chromatography (HPLC) including Liquid Chromatography Mass Spectrometry (LC-MS)

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
12.2	Complete required readings for Module 12.0		
12.3	Complete Study/Discussion Questions for Module 12.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
12.4.1	Observe LC-MS maintenance		
	Weekly maintenance LC-MS		
	Monthly maintenance LC-MS		
12.4.2	Perform supervised LC-MS maintenance		
	Weekly maintenance LC-MS		
	Monthly maintenance LC-MS		
12.4.3	Independently perform LC-MS maintenance		
	Weekly maintenance LC-MS		
	Monthly maintenance LC-MS		
12.4.4	Submit two training case samples involving LC-MS analysis		
	Case #:		
	Case #:		
DEMONSTRATION OF COMPETENCY			
		Trainee Initials & Date	**Trainer Initials & Date**
12.5.2	Trainee successfully completed and passed an Oral Board for Module 12.0		

Additional Notes:

Signatures below represent successful completion of Training Module 12.0

Trainee/Date	Technical Lead/Date	Unit Manager/Date

13.0 Infra-Red Spectroscopy (IR including FT-IR)

13.1 Objectives:

13.1.1 Knowledge of the principle/theory of IR (and FT-IR) in drug analysis:

- 13.1.1.1 Knowledge of the electromagnetic spectrum.
- 13.1.1.2 Knowledge of the theory and mechanism of absorption and of vibrational and rotational spectroscopy.
- 13.1.1.3 The Beer-Lambert Law.
- 13.1.1.4 Knowledge of the mechanism of IR as an identification technique, (characteristic IR group frequencies and structure/spectra correlations).
- 13.1.1.5 Fourier transform infrared spectroscopy (FT-IR) and different techniques (KBr, ATR, etc.).
- 13.1.1.6 Familiarity with the various instrumental components and their functions.
- 13.1.1.7 Awareness of common operational problems and causes, troubleshooting, preventive maintenance.

13.1.2 Knowledge of the application of IR (and FT-IR) in drug analysis:

- 13.1.2.1 Familiarity with the IR (and FT-IR) instrumentation and software (dispersive and interferometric spectrophotometers, data processing).
- 13.1.2.2 Familiarity with the operational procedures (sample purification and preparation, identification, and interpretation of spectra).
- 13.1.2.3 Practice in the application of IR (and FT-IR) methodology in the qualitative analysis of drugs most commonly encountered.
- 13.1.2.4 Proper use of spectral manipulations (e.g., subtraction, baseline correction, library searching), as applicable.
- 13.1.2.5 Ability to select operating parameters aiming at best results.
- 13.1.2.6 Practice in the preparation and handling of various kinds of samples.
- 13.1.2.7 Practice in the application of IR (and FT-IR) methodology in the analysis of drugs most commonly encountered.
- 13.1.2.8 Understanding the advantages and limitations of the technique.
- 13.1.2.9 Capacity of interpretation of the results obtained.

13.1.3 Understanding of related FCU procedures including, but not limited to, the following topics:

13.1.3.1 Weekly maintenance
13.1.3.2 Quarterly maintenance
13.1.3.3 Annual preventive maintenance
13.1.3.4 Validated methods used in FCU
13.1.3.5 Quality assurance procedures
13.1.3.6 Acceptance criteria for detecting CDS
13.1.3.7 Instrument troubleshooting and software familiarization

13.2 Reading Material:

13.2.1 FCS01 – SOP for Detecting Controlled Dangerous Substances (Document Control #4376)

13.2.2 FCS02 – SOP for General Laboratory Procedures for FCU (Document Control #5917)

13.2.3 FCS08 – SOP for Operating and Maintaining Fourier Transform Infrared Spectroscopy (FT-IR) Instruments (Document Control #7166)

13.2.4 “Introduction to Fourier Transform Infrared Spectrometry.” Thermo Nicolet (2001).

13.2.5 Clayborne, A., Morris, V., “Fourier Transform Infrared Spectroscopy (FTIR).” Howard University (2017).

13.2.6 “FT-IR Spectroscopy Attenuated Total Reflectance (ATR).” Perkin Elmer (2005).

13.3 Study/Discussion Questions:

13.3.1 What is the principle of IR spectroscopy?

13.3.2 What is the principle of FT-IR Spectroscopy?

13.3.3 How is FT-IR or IR spectroscopy used to identify substances?

13.3.4 What are the benefits of FT-IR?

13.3.5 What are the limitations of FT-IR?

13.3.6 Based on current validations, what substances can be detected by FTIR in FCU?

13.3.7 How often is maintenance performed?

13.3.8 What/Where is the fingerprint region? Why is this region important to us as chemists?

13.3.9 What does it mean to perform a “direct” analysis of a sample by FT-IR?

13.3.10 How often is FT-IR maintenance performed? What is documented/recorded?

Note: Study/discussion questions may be incorporated into mini oral quiz sessions or a written exam to evaluate the trainee’s understanding of topics covered in this module. It is the discretion of the trainee to answer questions for their training binder.

13.4 Practical Exercises/Skills:

13.4.1 Observe qualified chemist(s) perform weekly and quarterly maintenance on FT-IR. Note PPE used and steps followed to prevent contamination. Record date of observation in training binder.

13.4.2 Demonstrate the following maintenance under supervision by a trainer, using methods outlined in FCU SOPs. Record instrument status and information in the appropriate logbooks and control charts. *NOTE: Must be completed prior to trainee proceeding to independent exercises.

13.4.2.1 Weekly maintenance FT-IR
13.4.2.2 Quarterly maintenance FT-IR

13.4.3 Independently perform the following maintenance using methods outlined in FCU SOPs. Record instrument status and information in the appropriate logbooks and control charts. Document participation in training binder.

13.4.3.1 Weekly maintenance FT-IR
13.4.3.2 Quarterly maintenance FT-IR

13.4.4 Demonstrate understanding of FT-IR to the trainer by submitting at least two training samples performing the identification of a controlled substance using validated FCU procedures for FT-IR. Document practice case packet, if applicable, and feedback in training binder.

13.5 Demonstration of Competency:

13.5.1 Practical Exercises are successfully completed, results in the form of notes and/or photographs (where applicable) are included in training binder, and the trainer has reviewed for accuracy and meeting the objectives of the exercise(s). The trainer(s) may also sign off on the

module by oral discussion/proof of understanding of the material by the trainee.

13.5.2 Oral Board – Infra-Red Spectroscopy (IR including FT-IR). The Trainee must successfully complete an oral board, addressing in detail all topics outlined in the Objectives.

13.6 Documentation:

13.6.1 Completion of the tasks in this module will be documented on the checklist titled "Module 13.0 Checklist – Infra-Red Spectroscopy (IR including FT-IR)."

MODULE 13.0 CHECKLIST
Infrared Spectroscopy (IR including FT-IR)

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
13.2	Complete required readings for Module 13.0		
13.3	Complete Study/Discussion Questions for Module 13.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
13.4.1	Observe FT-IR maintenance		
	Weekly maintenance FT-IR		
	Quarterly maintenance FT-IR		
13.4.2	Perform supervised FT-IR maintenance		
	Weekly maintenance FT-IR		
	Quarterly maintenance FT-IR		
13.4.3	Independently perform FT-IR maintenance		
	Weekly maintenance FT-IR		
	Quarterly maintenance FT-IR		
13.4.4	Submit two training case samples involving FT-IR analysis		
	Case #:		
	Case #:		
DEMONSTRATION OF COMPETENCY			
		Trainee Initials & Date	**Trainer Initials & Date**
13.5.2	Trainee successfully completed and passed an Oral Board for Module 13.0		

Additional Notes:

Signatures below represent successful completion of Training Module 13.0.

Trainee/Date	Technical Lead/Date	Unit Manager/Date

14.0 Testing for Cannabis and Synthetic Cannabinoids

14.1 Objectives:

14.1.1 Familiarity with the illicit cannabis products:

- 14.1.1.1 Description of the cannabis plant and illicit cannabis products (names and synonyms, botany, physical appearance, morphological, microscopic and chemical characteristics, herbals, cannabis resin, liquid cannabis).
- 14.1.1.2 Breeding of cannabis plant (outdoor/indoor/industrial production, harvesting, yield).
- 14.1.1.3 Production of illicit cannabis products (herbal/resin/liquid cannabis).
- 14.1.1.4 Chemical components of forensic significance of illicit cannabis products.
- 14.1.1.5 Pharmacology of cannabis products.
- 14.1.1.6 Legal aspects concerning cannabis including hemp for fiber.

14.1.2 Familiarity with Cannabis Receptor Agonists (cannabimimetic compounds, e.g. ‘spice’ products), including legal aspects.

14.1.3 Familiarity with the protocol for the analysis of illicit cannabis products (including sampling, physical examination, microscopy, extraction, presumptive (aka “color” or “spot”) tests, GC, GC-MS, LC-MS, analytical challenges, special pitfalls).

14.1.4 Familiarity with additional analytical techniques for the analysis of cannabis.

14.1.5 Familiarity with analysis and identification of cannabimimetic compounds.

14.2 Reading Material:

14.2.1 FCS14 – SOP for the Analysis and Reporting of Suspected Marijuana (Document Control #31247)

14.2.2 “Recommended Methods for the Identification and Analysis of Cannabis and Cannabis Products”. UNODC. ST/NAR/40. March 2022.

14.2.3 “Recommended Methods for the Identification and Analysis of Synthetic Cannabinoid Receptor Agonists in Seized Materials.” UNODC. ST/NAR/48. July 2020.

14.2.4 “Terminology and Information on Drugs". UNODC. 2016. (1. – Cannabis; 2. – Synthetic Cannabinoid Receptor Agonists)

14.2.5 Marijuana Analysis for Forensic Chemists (Presentation, DEA, 2018)

14.2.6 “Hemp Production and the 2018 Farm Bill.” (Testimony, FDA, 2019)

14.2.7 “Drugs of Abuse.” Drug Enforcement Agency (2022 or latest edition) (Marijuana/Cannabis; Designer Drugs – K2/Spice)

14.3 Study/Discussion Questions:

14.3.1 Describe the criteria necessary to confirm CDS in each of the following. What would the conclusion be for each?

14.3.1.1 Marijuana
14.3.1.2 Marijuana resin (hashish)
14.3.1.3 Hash oil

14.3.2 What federal Schedule is marijuana? Describe the decriminalization of marijuana locally.

14.3.3 When and why is a composite necessary for marijuana. Describe the procedure.

14.3.4 What is the principal psychoactive ingredient in marijuana? Name two isomers and state whether they are controlled.

14.3.5 Name 4 cannabinoids. Which are controlled and what are their schedules?

14.3.6 What is sinsemilla? Does the male plant produce flowers?

14.3.7 Are the seeds and/or stalk of the marijuana plant controlled? What are the criteria to be classified as hemp (according to the 2018 Farm Bill)?

14.3.8 Are there any other plants that have cystolithic hairs?

14.3.9 What is the difference between the Duquenois test, the Duquenois-Levine test, the Rapid Duquenois Levine test, and the Modified Duquenois test?

14.3.10 What is the role of the hydrochloric acid during the Duquenois color test reaction?

14.3.11 Draw the structures of delta-9-tetrahydrocannabinol, cannabinol, and cannabidiol.

14.3.12 How is cannabinol formed from THC and what factors contribute to this?

14.3.13 What are synthetic cannabinoids? Describe their appearance, pharmacology, and chemical characteristics.

14.3.14 Describe the scheduling of synthetic cannabinoids.

14.3.15 Name five synthetic cannabinoids.

14.3.16 Describe the procedure for detecting a synthetic cannabinoid. List the analytical techniques and specific methods used.

Note: Study/discussion questions may be incorporated into mini oral quiz sessions or a written exam to evaluate the trainee's understanding of topics covered in this module. It is the discretion of the trainee to answer questions for their training binder.

14.4 Practical Exercises/Skills:

14.4.1 Observe qualified chemist(s) perform presumptive and confirmatory tests for the identification of Marijuana, Delta-9-Tetrahydrocannabinol, and/or synthetic cannabinoid using the methods outlined in the FCU SOPs on a minimum of three cases. Observe and review casework note-taking and documentation. On the 30-Day Progress Report form, record the following: case number, qualified analyst(s) observed, date of observation, type of exam and number of items.

14.4.2 Demonstrate successful identification of marijuana, THC, or a synthetic cannabinoid in plant material by completion of a training case observed by the trainer. Record results on worksheets as appropriate and take notes according to laboratory protocol. *NOTE: Must be completed prior to trainee proceeding to independent exercises. Training case should consist of the following techniques:

14.4.2.1 Microscopic Evaluation

14.4.2.1.1 View plant material under the appropriate magnification and note appearance. Identify and label cystolithic and non-cystolithic hairs, if present.

14.4.2.2 Color Test

14.4.2.2.1 Perform the Duquenois-Levine color test and document observed color changes.

14.4.2.3 GC-MS and GC-FID

14.4.2.3.1 Perform an extraction and document results of GC-MS. Perform structural identification and confirm the presence of controlled dangerous substances, if applicable.

14.4.2.3.2 If necessary, perform and extraction and document results of GC-FID. Confirm the presence of controlled dangerous substances, if applicable.

14.4.3 Perform independent examination and identification of a cannabis or synthetic cannabinoid material on a minimum of three training case samples, representative of samples routinely encountered in casework. Use methods outlined in the laboratory FCU SOPs. Document on the 30-Day Progress Report form. Practice cases shall be reviewed for accuracy of analysis and conclusions.

14.5 Demonstration of Competency:

14.5.1 Practical Exercises are successfully completed, results in the form of notes and/or photographs (where applicable) are included in training binder, and the trainer has reviewed for accuracy and meeting the objectives of the exercise(s). The trainer(s) may also sign off on the module by oral discussion/proof of understanding of the material by the trainee.

14.5.2 Practical Exam: Successful analysis and identification of a cannabis or synthetic cannabinoid product using FCU Standard Operating Procedures. Note: Completed independent training cases may be used as the practical exam.

14.5.3 Oral Board – Testing for Cannabis and Synthetic Cannabinoids. Trainee must successfully complete an oral board, addressing in detail all topics outlined in the Objectives.

14.6 Documentation:

14.6.1 Completion of the tasks in this module will be documented on the checklist titled “Module 14.0 Checklist – Testing for Cannabis and Synthetic Cannabinoids.”

MODULE 14.0 CHECKLIST
Testing for Cannabis and Synthetic Cannabinoids

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
14.2	Complete required readings for Module 14.0		
14.3	Complete Study/Discussion Questions for Module 14.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
14.4.1	Observe examination and identification of marijuana, D9-THC, and/ or synthetic cannabinoids in casework samples		
	Case #:		
	Case #:		
	Case #:		
14.4.2	Demonstrate examination and identification of marijuana, D9-THC, and/or synthetic cannabinoids in a supervised training case		
	Case #:		
14.4.3	Perform independent examination and identification of a cannabis or synthetic cannabinoid material in training case samples		
	Case #:		
	Case #:		
	Case #:		
DEMONSTRATION OF COMPETENCY			
		Trainee Initials & Date	**Trainer Initials & Date**
14.5.2	Practical exam: Trainee correctly identified the presence of a cannabinoid or synthetic cannabinoid in an unknown sample Case #:		
14.5.3	Trainee successfully completed and passed an Oral Board for Module 14.0		

Additional Notes:

Signatures below represent successful completion of Training Module 14.0.

_____ _____ _____

Trainee/Date Technical Lead/Date Unit Manager/Date

15.0 Testing for Opium Alkaloids, Opium Derivatives and Synthetic Opioids

15.1 Objectives:

15.1.1 Familiarity with the opium, opium alkaloids and opium derivatives (heroin) including synthetic and semi-synthetic opioids (oxycodone, hydrocodone, fentanyl, etc.):

15.1.1.1 Description/recognition of illicit opium products (botany, physical appearance, morphological and chemical characteristics, opium preparations) as well as synthetic opioid products

15.1.1.2 Production of illicit opium products (isolation of morphine from opium, manufacture of heroin from morphine).

15.1.1.3 Chemical constituents of forensic significance of illicit opioid products and derivatives, including by-products, adulterants and diluents, comparative analysis / establishing links between samples.

15.1.1.4 Structures and pharmacology of constituents of opium, opium derivatives (heroin), semi-synthetic opioids and synthetic opioids.

15.1.1.5 Legal aspects concerning opium, opioid derivatives (heroin), semi-synthetic and synthetic opioids.

15.1.2 Familiarity with the protocol for the analysis of illicit opium, opium products, opium derivatives (heroin), synthetic and semi-synthetic opioids (including sampling, physical examination, extraction, presumptive (color/spot and pharmaceutical identification) tests, GC, GC-MS, LC-MS, analytical challenges, and special pitfalls).

15.1.3 Familiarity with additional analytical techniques for the analysis of illicit opium, opium products, opium derivatives (heroin), semi-synthetic, and synthetic opioids.

15.2 Reading Material:

15.2.1 “Recommended Methods for Testing Opium, Morphine and Heroin”, UNODC, ST/NAR/29/Rev.1, June 1998.

15.2.2 “Terminology and Information on Drugs". UNODC. 2016. (3. – Opium and Opiates; 4. - Opioids)

15.2.3 “Drugs of Abuse.” Drug Enforcement Agency (2022 or latest edition) (Narcotics)

15.2.4 “Utopioids.” Cayman Chemical (2018)

15.3 Study/Discussion Questions:

15.3.1 What is the term “Alkaloid” used to describe?

15.3.2 What is the difference between a naturally occurring opioid, semi-synthetic opioid, and synthetic opioid? Name three examples of each.

15.3.3 What is the main medical use of opioids?

15.3.4 What are the principle psychoactive ingredients in the poppy plant?

15.3.5 What process gives rise to 6-Monoacetylmorphine? Draw the structures Heroin, 6-Monoacetylmorphine, and morphine.

15.3.6 Draw the structure of Fentanyl.

15.3.7 Name five Fentanyl analogs.

15.3.8 What are utopioids? Name two examples.

15.3.9 What are some common controlled and uncontrolled substances found with Fentanyl? Which are directly related (i.e. precursors or breakdown products)?

15.3.10 What schedules are Heroin, Fentanyl, and Oxycodone, and why?

15.3.11 What types of counterfeit pills are typically seen? Describe the physical characteristics (shape, color, imprint), constituents of the legitimate pills, and commonly found constituents of counterfeit pills.

Note: Study/discussion questions may be incorporated into mini oral quiz sessions or a written exam to evaluate the trainee’s understanding of topics covered in this module. It is the discretion of the trainee to answer questions for their training binder.

15.4 Practical Exercises/Skills:

15.4.1 Observe qualified chemist(s) perform presumptive and confirmatory tests for the identification of opioids using the methods outlined in the FCU SOPs on a minimum of three cases. Observe and review casework note-taking and documentation. On the 30-Day Progress Report form, record the following: case number, qualified analyst(s) observed, date of observation, type of exam and number of items.

15.4.2 Demonstrate successful identification of an opioid by completion of a training case observed by the trainer. Record results on worksheets as appropriate and take notes according to laboratory protocol. *NOTE: Must be completed prior to trainee proceeding to independent exercises. Training case should consist of the following techniques:

15.4.2.1 Color Test

15.4.2.1.1 Perform the Marquis color test and document observed color changes. Discuss possible limitations of this method with the trainer.

15.4.2.2 GC-MS and GC-FID

15.4.2.2.1 Perform an extraction and document results of GC-MS. Perform structural identification and confirm the presence of controlled dangerous substances, if applicable. Discuss possible limitations of this method with the trainer.

15.4.2.2.2 If necessary, perform an extraction and document the results of GC-FID. Confirm the presence of controlled dangerous substances, if applicable. Discuss possible limitations of this method with the trainer.

15.4.3 Perform independent examination and identification of opioids on a minimum of three training case samples, representative of samples routinely encountered in casework. Use methods outlined in the laboratory FCU SOPs. Document on the 30-Day Progress Report form. Practice cases shall be reviewed for accuracy of analysis and conclusions.

15.5 Demonstration of Competency:

15.5.1 Practical Exercises are successfully completed, results in the form of notes and/or photographs (where applicable) are included in training binder, and the trainer has reviewed for accuracy and meeting the objectives of the exercise(s). The trainer(s) may also sign off on the module by oral discussion/proof of understanding of the material by the trainee.

15.5.2 Successful analysis and identification of an opioid product using FCU Standard Operating Procedures. Note: Completed independent training cases may be used as the practical exam.

15.5.3 Oral Board – Testing for Opium Alkaloids, Opium Derivatives and Synthetic Opioids. Trainee must successfully complete an oral board, addressing in detail all topics outlined in the Objectives.

15.6 Documentation:

15.6.1 Completion of the tasks in this module will be documented on the checklist titled “Module 15.0 Checklist – Testing for Opium Alkaloids, Opium Derivatives and Synthetic Opioids.”

MODULE 15.0 CHECKLIST
Testing for Opium Alkaloids, Opium Derivatives, and Synthetic Opioids

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
15.2	Complete required readings for Module 15.0		
15.3	Complete Study/Discussion Questions for Module 15.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
15.4.1	Observe examination and identification of opioids in casework samples		
	Case #:		
	Case #:		
	Case #:		
15.4.2	Demonstrate examination and identification of an opioid in a supervised training case		
	Case #:		
15.4.3	Perform independent examination and identification of opioids in training case samples		
	Case #:		
	Case #:		
	Case #:		
DEMONSTRATION OF COMPETENCY			
		Trainee Initials & Date	**Trainer Initials & Date**
15.5.2	Practical exam: Trainee correctly identified the presence of an opioid in an unknown sample Case #:		
15.5.3	Trainee successfully completed and passed an Oral Board for Module 15.0		

Additional Notes:

Signatures below represent successful completion of Training Module 15.0.

_____ _____ _____

Trainee/Date Technical Lead/Date Unit Manager/Date

16.0 Quantitative Testing for Heroin by GC-FID

16.1 Objectives:

16.1.1 Familiarity with the protocol for running calibration and QC checks of heroin standards on GC-FID.

16.1.2 Familiarity with how to prepare QC, calibration, and solvent (quant solution) solutions.

16.1.3 Familiarity with the forms and calculations for quantitation of heroin samples.

16.1.4 Familiarity with the sample preparation for a heroin casework sample.

16.1.5 Familiarity with the acceptance criteria, reporting procedures, interpretation of results, and calculations for quantitated samples.

16.1.6 Familiarity of uncertainty calculations.

16.1.7 Familiarity of annual calibration curve and linearity check.

16.2 Reading Material:

16.2.1 FCS15 – SOP for Quantitation of Heroin using GC-FID (Document Control #8691)

16.2.2 FCS21 – Procedure for Uncertainty in Measurement (Document Control #10141)

16.2.3 FCU Annual Linearity Check documents (previous records)

16.3 Study/Discussion Questions:

16.3.1 Why is heroin quant analysis performed in DC?

16.3.2 What is the process to quantitate a heroin sample? How much sample and solvent are used?

16.3.3 Are there any instances when quantitation would not be performed on a heroin sample? Are there any instances when quantitation is performed but the value is not reported?

16.3.4 Which balances in the laboratory are available for quantitative analysis? What volumetric glassware is available for quantitative analysis?

16.3.5 How is the quant solution made, and where is it recorded?

16.3.6 Explain the purpose of the following solutions: Calibrant, QC Low, QC High.

16.3.7 What is the process to make the QC Low and QC High? Where is this recorded? How often do these need to be made/expire?

16.3.8 What is the process to make the calibrant? Where is this recorded? How often does this need to be made/expire?

16.3.9 What should you do if the calibrant auto-prints to a value below 100? Why does this happen?

16.3.10 Explain the significance of the internal standard signal and why it is important. What might abnormally high responses indicate?

16.3.11 What are the acceptance criteria for QC solutions?

16.3.12 What are the acceptance criteria for samples? Describe the procedure for samples that do not meet the acceptance criteria.

16.3.13 How often is the uncertainty recalculated?

16.3.14 What factors contribute to quant uncertainty calculations?

16.3.15 What is the purpose of an annual calibration curve/linearity check? What is the process?

16.3.16 Where are the quant control charts located? Where are the sequence print-outs saved?

Note: Study/discussion questions may be incorporated into mini oral quiz sessions or a written exam to evaluate the trainee's understanding of topics covered in this module. It is the discretion of the trainee to answer questions for their training binder.

16.4 Practical Exercises/Skills:

16.4.1 Observe qualified chemist(s) perform quantitative analysis of heroin samples using the methods outlined in the FCU SOPs on a minimum of three cases. Observe and review casework note-taking and documentation. On the 30-Day Progress Report form, record the following: case number, qualified analyst(s) observed, date of observation, type of exam and number of items.

16.4.2 Discuss the following chemicals and solutions used in the heroin quantitation procedure. Prepare at least one of the following under supervision following methods outlined in FCU SOPs. Run sample(s) as

a quality check using validated methods and review the results with the trainer. Fill purity worksheets, control charts, and logbooks as applicable.

16.4.2.1 Quant Solution
16.4.2.2 Calibrant
16.4.2.3 QC Low
16.4.2.4 QC High

16.4.3 Demonstrate successful quantitation of heroin by completion of a training case observed by the trainer. Record results on worksheets as appropriate and take notes according to laboratory protocol. *NOTE: Must be completed prior to trainee proceeding to independent exercises.

16.4.4 Perform quantitative analysis of heroin on a minimum of three training samples, representative of samples routinely encountered in casework. Use methods outlined in the laboratory FCU SOPs. Document on the 30-Day Progress Report form. Each practice case should be reviewed for accuracy of analysis and conclusions.

16.5 Demonstration of Competency:

16.5.1 Practical Exercises are successfully completed, results in the form of notes and/or photographs (where applicable) are included in training binder, and the trainer has reviewed for accuracy and meeting the objectives of the exercise(s). The trainer(s) may also sign off on the module by oral discussion/proof of understanding of the material by the trainee.

16.5.2 Practical Exam: Successful quantitative analysis and purity determination of a heroin sample using FCU Standard Operating Procedures. Note: Completed independent training cases may be used as the practical exam.

16.5.3 Oral Board Exam - Quantitative Testing for Heroin by GC-FID. Trainee must successfully complete an oral board, addressing in detail all topics outlined in the Objectives.

16.6 Documentation:

16.6.1 Completion of the tasks in this module will be documented on the checklist titled "Module 16.0 Checklist – Quantitative Testing for Heroin by GC-FID."

MODULE 16.0 CHECKLIST
Quantitative Testing for Heroin by GC-FID

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
16.2	Complete required readings for Module 16.0		
16.3	Complete Study/Discussion Questions for Module 16.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
16.4.1	Observe quantitative analysis of heroin in casework samples		
	Case #:		
	Case #:		
	Case #:		
16.4.2	Prepare at least one solution used for heroin quantitation and perform a quality check		
16.4.3	Demonstrate quantitative analysis of heroin in a supervised training case		
	Case #:		
16.4.4	Perform independent quantitative analysis of heroin in training case samples		
	Case #:		
	Case #:		
	Case #:		
DEMONSTRATION OF COMPETENCY			
		Trainee Initials & Date	**Trainer Initials & Date**
16.5.2	Practical exam: Trainee correctly identified the purity of heroin in an unknown sample Case #:		
16.5.3	Trainee successfully completed and passed an Oral Board for Module 16.0		

Additional Notes:

Signatures below represent successful completion of Training Module 16.0.

Trainee/Date	Technical Lead/Date	Unit Manager/Date

17.0 Testing for Cocaine

17.1 Objectives:

17.1.1 Familiarity with the coca plant and illicit materials containing cocaine:

17.1.1.1 Description/recognition of coca plant and illicit materials containing cocaine (botany, physical appearance, morphological and chemical characteristics).

17.1.1.2 Production of illicit materials containing cocaine (isolation of cocaine from coca leaf, production of coca paste, cocaine base, "crack") and manufacture of cocaine.

17.1.1.3 Chemical constituents of forensic significance of coca plant and illicit materials containing cocaine, including by-products, adulterants and diluents, comparative analysis / establishing links between cocaine samples.

17.1.1.4 Structures, physical data and pharmacology of constituents of illicit materials containing cocaine.

17.1.1.5 Legal aspects concerning coca plant and illicit materials containing cocaine.

17.1.2 Familiarity with the protocol for the analysis of illicit materials containing cocaine (including sampling, physical identification, extraction, presumptive (color) tests, GC, GC-MS, FT-IR, LC-MS, analytical challenges, special pitfalls).

17.1.3 Familiarity with additional analytical techniques for the analysis of cocaine.

17.2 Reading Material:

17.2.1 "Recommended Methods for Testing Cocaine". UNODC ST/NAR/7. March 2012.

17.2.2 “Terminology and Information on Drugs". UNODC. 2016. (5. – Coca and Cocaine)

17.2.3 “Drugs of Abuse.” Drug Enforcement Agency (2022 or latest edition) (Stimulants - Cocaine)

17.3 Study/Discussion Questions:

17.3.1 What schedule is cocaine?

17.3.2 What kind of drug class/category does cocaine fall within?

17.3.3 Why do we differentiate between salt and base forms? What is the procedure if you cannot definitively identify the form?

17.3.4 Draw the structural difference between cocaine hydrochloride and cocaine base. How would this influence the FT-IR spectra?

17.3.5 What are the three basic groups of alkaloids present in cocaine?

17.3.6 Why is baking soda commonly recovered during cocaine seizures?

17.3.7 What are some other common cutting agents or diluents seen with cocaine in the District?

17.3.8 What is Levamisole? What is it used for?

17.3.9 What color tests can be used to presumptively detect cocaine and what do positive results look like?

17.3.10 How would you analyze a sample containing cocaine base and levamisole by FT-IR? Note solvents that may be required for adequate separation. Discuss the limitations of identifying mixtures with trainer.

17.3.11 How would you analyze a sample containing cocaine base and phenacetin by FT-IR? Note solvents that may be required for adequate separation.

17.3.12 How would you analyze a sample containing cocaine hydrochloride and phenacetin by FT-IR? Note solvents that may be required for adequate separation.

17.3.13 Since the cocaine molecule contains two carbonyl groups, would you expect the IR of the carbonyl region to have one or two absorption peaks? Why?

Note: Study/discussion questions may be incorporated into mini oral quiz sessions or a written exam to evaluate the trainee's understanding of topics covered in this module. It is the discretion of the trainee to answer questions for their training binder.

17.4 Practical Exercises/Skills:

17.4.1 Observe qualified chemist(s) perform presumptive and confirmatory tests for the identification of cocaine base and/or cocaine hydrochloride using the methods outlined in the FCU SOPs on a minimum of three cases. Observe and review casework note-taking and documentation. On the 30-Day Progress Report form, record the following: case,

qualified analyst(s) observed, date of observation, type of exam and number of items.

17.4.2 Demonstrate successful identification of cocaine by completion of a training case observed by the trainer. Record results on worksheets as appropriate and take notes according to laboratory protocol. *NOTE: Must be completed prior to trainee proceeding to independent exercises. Training case should consist of the following techniques:

17.4.2.1 Color Tests

17.4.2.1.1 Perform the Cobalt Thiocyanate color test and document observed color changes. Discuss possible limitations of this method with the trainer.

17.4.2.1.2 Perform the Marquis color test and document observed color changes. Discuss possible limitations of this method with the trainer.

17.4.2.2 GC-MS

17.4.2.2.1 Perform an extraction and document results of GC-MS. Perform structural identification and confirm the presence of controlled dangerous substances, if applicable. Discuss possible limitations of this method with the trainer.

17.4.2.3 FT-IR

17.4.2.3.1 Perform a direct analysis and document results of FT-IR. Perform extractions as necessary to confirm the presence of controlled dangerous substances, if applicable. Discuss possible limitations of this method with the trainer.

17.4.3 Perform independent examination and identification of cocaine on a minimum of three training case samples, representative of samples routinely encountered in casework. Use methods outlined in the laboratory FCU SOPs. Document on the 30-Day Progress Report form. Practice cases shall be reviewed for accuracy of analysis and conclusions.

17.5 Demonstration of Competency:

17.5.1 Practical Exercises are successfully completed, results in the form of notes and/or photographs (where applicable) are included in training binder, and the trainer has reviewed for accuracy and meeting the objectives of the exercise(s). The trainer(s) may also sign off on the module by oral discussion/proof of understanding of the material by the trainee.

17.5.2 Practical Exam: Successful analysis and identification of cocaine using FCU Standard Operating Procedures. Note: Completed independent training cases may be used as the practical exam.

17.5.3 Oral Board Exam – Testing for Cocaine. Trainee must successfully complete an oral board, addressing in detail all topics outlined in the Objectives.

17.6 Documentation:

17.6.1 Completion of the tasks in this module will be documented on the checklist titled "Module 17.0 Checklist – Testing for Cocaine."

MODULE 17.0 CHECKLIST
Testing for Cocaine

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
17.2	Complete required readings for Module 17.0		
17.3	Complete Study/Discussion Questions for Module 17.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
17.4.1	Observe examination and identification of cocaine in casework samples		
	Case #:		
	Case #:		
	Case #:		
17.4.2	Demonstrate examination and identification of cocaine in a supervised training case		
	Case #:		
17.4.3	Perform independent examination and identification of cocaine in training case samples		
	Case #:		
	Case #:		
	Case #:		
DEMONSTRATION OF COMPETENCY			
		Trainee Initials & Date	**Trainer Initials & Date**
17.5.2	Practical exam: Trainee correctly identified the presence of cocaine in an unknown sample Case #:		
17.5.3	Trainee successfully completed and passed an Oral Board for Module 17.0		

Additional Notes:

Signatures below represent successful completion of Training Module 17.0.

_____ _____ _____

Trainee/Date Technical Lead/Date Unit Manager/Date

18.0 Testing for Amphetamine Type Stimulants (ATS)

18.1 Objectives:

18.1.1 Familiarity with the Amphetamine Type Stimulants:

- 18.1.1.1 Non-ring substituted amphetamines (e.g., amphetamine, methamphetamine, cathine, cathinone)
- 18.1.1.2 Methylenedioxy substituted amphetamines (e.g., MDA, MDMA)
- 18.1.1.3 Other ring substituted amphetamines (also in section "Hallucinogens")
- 18.1.1.4 2,4,5-Ring substituted phenethylamines
- 18.1.1.5 2,4,5-Ring substituted amphetamines
- 18.1.1.6 Other ring substitution patterns (phenethylamines and amphetamines) (e.g., Mescaline, PMA, PMMA, DMA, TMA, 4-MTA)
- 18.1.1.7 Classification and respective definitions
- 18.1.1.8 Description of compounds, physical and chemical characteristics, stereochemistry
- 18.1.1.9 Illicit ATS manufacture, including synthesis of amphetamine, methamphetamine and ring-substituted ATS (XTC-group, etc.)
- 18.1.1.10 Pharmacology of Amphetamine Type Stimulants
- 18.1.1.11 Legal aspects

18.1.2 Familiarity with the protocol for the analysis of Amphetamine Type Stimulants (including sampling, physical description, extraction, presumptive color tests, GC, GC-MS, FT-IR, LC-MS, analytical challenges, special pitfalls).

18.1.3 Familiarity with additional analytical techniques for the analysis of Amphetamine Type Stimulants.

18.2 Reading Material:

18.2.1 “Terminology and Information on Drugs". UNODC. 2016. (6. – Amphetamine Type Stimulants)

18.2.2 "Recommended Methods for the Identification and Analysis of Amphetamine Methamphetamine and their Ring-substituted Analogues in Seized Materials". UNODC. ST/NAR/34. Jan. 2006.

18.2.3 “Recommended Methods for the Identification and Analysis of Synthetic Cathinones in Seized Materials”. UNODC. ST/NAR/49. March 2020.

18.2.4 "Drugs of Abuse." Drug Enforcement Agency (2022 or latest edition) (Stimulants – Amphetamines; Stimulants – Khat, Stimulants – Methamphetamine, Designer Drugs – Bath Salts)

18.2.5 D.C. Act 22-550: Revised Synthetics Abatement and Full Enforcement Drug Control Congressional Review Emergency Amendment Act of 2018

18.3 Study/Discussion Questions:

18.3.1 What is the process to analyze amphetamine type stimulants?

18.3.2 What is the common core structure of amphetamine type stimulants? Draw the structures of Amphetamine and Methamphetamine.

18.3.3 What schedules are Amphetamine, Methamphetamine, and MDMA?

18.3.4 What are the psychoactive ingredients of khat?

18.3.5 What is the structure of Cathinone?

18.3.6 What color tests are used to presumptively identify Amphetamine, Methamphetamine, and synthetic cathinones? What would positive reactions look like?

18.3.7 What are some limitations or challenges of detecting methamphetamine and amphetamine by GCMS?

18.3.8 What are some limitations or challenges of detecting synthetic cathinones by GCMS?

18.3.9 Name five synthetic cathinones.

18.3.10 What are two slang terms for MDMA?

18.3.11 When and why was MDMA first introduced?

18.3.12 What is SAFEDC? What does it stand for?

Note: Study/discussion questions may be incorporated into mini oral quiz sessions or a written exam to evaluate the trainee's understanding of topics covered in this module. It is the discretion of the trainee to answer questions for their training binder.

18.4 Practical Exercises/Skills:

18.4.1 Observe qualified chemist(s) perform quantitative analysis of ATS samples using the methods outlined in the FCU SOPs on a minimum of three cases. Observe and review casework note-taking and documentation. On the 30-Day Progress Report form, record the following: case number, qualified analyst(s) observed, date of observation, type of exam and number of items.

18.4.2 Demonstrate successful identification of an ATS by completion of a training case observed by the trainer. Record results on worksheets as appropriate and take notes according to laboratory protocol. *NOTE: Must be completed prior to trainee proceeding to independent exercises. Training case should consist of the following techniques:

18.4.2.1 Color Test

18.4.2.1.1 Perform the Marquis color test and document observed color changes. Discuss possible limitations of this method with the trainer.

18.4.2.2 GC-MS

18.4.2.2.1 Perform a methanol extraction and document the results of GC-MS. Perform structural identification and confirm the presence of controlled dangerous substances, if applicable. Note peak shape. Discuss results with trainer.

18.4.2.2.2 Perform a chloroform (or 9:1 chloroform:methanol) extraction and document the results of GC-MS. Perform structural identification and confirm the presence of controlled dangerous substances, if applicable. Note peak shape. Discuss results with trainer.

18.4.2.2.3 Perform a basic extraction (ammoniacal chloroform or 9:1 chloroform:methanol) and document the results of GC-MS. Perform structural identification and confirm the presence of controlled dangerous substances, if applicable. Note peak shape. Discuss results with trainer.

18.4.3 Perform independent examination and identification of an ATS on a minimum of three training case samples, representative of samples routinely encountered in casework. Use methods outlined in the

laboratory FCU SOPs. Document on the 30-Day Progress Report form. Practice cases shall be reviewed for accuracy of analysis and conclusions.

18.5 Demonstration of Competency:

18.5.1 Practical Exercises are successfully completed, results in the form of notes and/or photographs (where applicable) are included in training binder, and the trainer has reviewed for accuracy and meeting the objectives of the exercise(s). The trainer(s) may also sign off on the module by oral discussion/proof of understanding of the material by the trainee.

18.5.2 Practical Exam: Successful analysis and identification of an ATS product using FCU Standard Operating Procedures. Note: Completed independent training cases may be used as the practical exam.

18.5.3 Oral Board - Testing for Amphetamine Type Stimulants (ATS). Trainee must successfully complete an oral board, addressing in detail all topics outlined in the Objectives.

18.6 Documentation:

18.6.1 Completion of the tasks in this module will be documented on the checklist titled "Module 18.0 Checklist – Testing for Amphetamine Type Stimulants (ATS)."

MODULE 18.0 CHECKLIST
Testing for Amphetamine Type Stimulants (ATS)

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
18.2	Complete required readings for Module 18.0		
18.3	Complete Study/Discussion Questions for Module 18.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
18.4.1	Observe examination and identification of ATS in casework samples		
	Case #:		
	Case #:		
	Case #:		
18.4.2	Demonstrate examination and identification of ATS in a supervised training case		
	Case #:		
18.4.3	Perform independent examination and identification of ATS in training case samples		
	Case #:		
	Case #:		
	Case #:		
DEMONSTRATION OF COMPETENCY			
		Trainee Initials & Date	**Trainer Initials & Date**
18.5.2	Practical exam: Trainee correctly identified the presence of ATS in an unknown sample Case #:		
18.5.3	Trainee successfully completed and passed an Oral Board for Module 18.0		

Additional Notes:

Signatures below represent successful completion of Training Module 18.0.

_____ _____ _____

Trainee/Date Technical Lead/Date Unit Manager/Date

19.0 Testing for Hallucinogens (Phencyclidine, LSD, Mescaline, Psilocybin/Psilocin)

19.1 Objectives:

19.1.1 Familiarity with various types of Hallucinogens

- 19.1.1.1 Phencyclidine (PCP) and related substances
- 19.1.1.2 Lysergic Acid Diethylamide (LSD)
- 19.1.1.3 Psilocybin/Psilocin (Psilocybe Mushrooms)
- 19.1.1.4 Mescaline (Peyote Cactus – Mescal Buttons)
- 19.1.1.5 Other substituted tryptamines and other hallucinogenic phenethylamines (2-CB, STP, DOB, TMA, etc., also referred to in section “ATS”).
- 19.1.1.6 Description/recognition of plants or illicit products
- 19.1.1.7 Illicit production/manufacture of illicit products
- 19.1.1.8 Chemical compounds, structures and pharmacology
- 19.1.1.9 Legal aspects of hallucinogens

19.1.2 Familiarity with the protocol for the analysis of hallucinogens (including physical identification, sampling, extraction, presumptive tests (color), GC, GC-MS, LC-MS, analytical challenges).

19.1.3 Familiarity with additional analytical techniques for the analysis of hallucinogens.

19.2 Reading Material:

19.2.1 “Terminology and Information on Drugs". UNODC. 2016. (8. - Hallucinogens)

19.2.2 “Recommended Methods for Testing Lysergide (LSD)”, UNODC, ST/NAR/17, January 1989.

19.2.3 “Recommended Methods for Testing Peyote Cactus (Mescal Buttons)/Mescaline and Psilocybe Mushrooms / Psilocybin” UNODC, ST/NAR/19, December 1989.

19.2.4 “Drugs of Abuse.” Drug Enforcement Agency (2022 or latest edition) (Hallucinogens)

19.3 Study/Discussion Questions:

19.3.1 What does PCP stand for?

19.3.2 What schedule is PCP?

19.3.3 In what form or forms is PCP usually sold?

19.3.4 What is the process to analyze PCP liquid, PCP cigarette, and PCP residue?

19.3.5 What specific instrumental methods are used to detect PCP, when are they used, and what are the limitations to these?

19.3.6 What other controlled substances are commonly found with PCP?

19.3.7 What does LSD stand for?

19.3.8 Name two ergot alkaloids.

19.3.9 What is the common name and the taxonomical name (genus and species) for the mold found on wheat/rye and used to make LSD?

19.3.10 What is the starting material for the synthesis of LSD?

19.3.11 What does prolonged exposure to UV light do to LSD?

19.3.12 What is the process to analyze LSD?

19.3.13 In what form is LSD usually sold?

19.3.14 What are some challenges or difficulties when analyzing LSD?

19.3.15 What schedule is LSD?

19.3.16 What is the process to analyze Psilocybin mushrooms?

19.3.17 What are some challenges or difficulties when analyzing mushrooms?

19.3.18 Do Psilocybin mushrooms have any distinct features?

19.3.19 Where can Psilocybin mushrooms be found naturally?

19.3.20 What schedule is Psilocybin? What schedule is Psilocin?

19.3.21 What is the principal active ingredient of peyote? Is it scheduled?

19.3.22 What is peyote? Describe its physical appearance.

19.3.23 Are peyote cacti available legally in the US? Are there exceptions?

19.3.24 Define the term indole. Name some common indole hallucinogens.

19.3.25 Define the term catechol. Name some common catechol hallucinogens.

19.3.26 Where can DMT be found?

19.3.27 What is sage/diviner's sage?

Note: Study/discussion questions may be incorporated into mini oral quiz sessions or a written exam to evaluate the trainee's understanding of topics covered in this module. It is the discretion of the trainee to answer questions for their training binder.

19.4 Practical Exercises/Skills:

19.4.1 Observe qualified chemist(s) perform qualitative analysis of hallucinogens using the methods outlined in the FCU SOPs on a minimum of three cases. Observe and review casework note-taking and documentation. On the 30-Day Progress Report form, record the following: case number, qualified analyst(s) observed, date of observation, type of exam and number of items.

19.4.2 Demonstrate successful identification of a hallucinogen by completion of a training case observed by the trainer. Record results on worksheets as appropriate and take notes according to laboratory protocol. *NOTE: Must be completed prior to trainee proceeding to independent exercises. Training case should consist of the following techniques:

19.4.2.1 Color Test, if applicable (for PCP samples)

19.4.2.1.1 Perform the Mayer's color test and document observed color changes.

19.4.2.1.2 Perform the Cobalt Thiocyanate color test and document observed color changes.

19.4.2.2 GC-MS

19.4.2.2.1 Perform an extraction and document results of GC-MS. Perform structural identification on confirm the presence of controlled dangerous substances, if applicable.

19.4.2.3 GC-FID

19.4.2.3.1 Perform an extraction and document results of GC-FID, if necessary. Confirm the presence of controlled dangerous substances, if applicable.

19.4.3 Perform independent examination and identification of a hallucinogen on a minimum of three training case samples, representative of samples

routinely encountered in casework. Use methods outlined in the laboratory FCU SOPs. Document on the 30-Day Progress Report form. Practice cases shall be reviewed for accuracy of analysis and conclusions.

19.5 Demonstration of Competency:

19.5.1 Practical Exercises are successfully completed, results in the form of notes and/or photographs (where applicable) are included in training binder, and the trainer has reviewed for accuracy and meeting the objectives of the exercise(s). The trainer(s) may also sign off on the module by oral discussion/proof of understanding of the material by the trainee.

19.5.2 Practical Exam: Successful analysis and identification of a hallucinogen product using FCU Standard Operating Procedures. Note: Completed independent training cases may be used as the practical exam.

19.5.3 Oral Board – Testing for Hallucinogens (Phencyclidine, LSD, Mescaline, Psilocybin/Psilocin). Trainee must successfully complete an oral board, addressing in detail all topics outlined in the Objectives.

19.6 Documentation:

19.6.1 Completion of the tasks in this module will be documented on the checklist titled “Module 19.0 Checklist – Testing for Hallucinogens (Phencyclidine, LSD, Mescaline, Psilocybin/Psilocin).”

MODULE 19.0 CHECKLIST
Testing for Hallucinogens (Phencyclidine, LSD, Mescaline, Psilocybin/Psilocin)

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
19.2	Complete required readings for Module 19.0		
19.3	Complete Study/Discussion Questions for Module 19.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
19.4.1	Observe examination and identification of a hallucinogen in casework samples		
	Case #:		
	Case #:		
	Case #:		
19.4.2	Demonstrate examination and identification of a hallucinogen in a supervised training case		
	Case #:		
19.4.3	Perform independent examination and identification of a hallucinogen in training case samples		
	Case #:		
	Case #:		
	Case #:		
DEMONSTRATION OF COMPETENCY			
		Trainee Initials & Date	**Trainer Initials & Date**
19.5.2	Practical exam: Trainee correctly identified the presence of a hallucinogen in an unknown sample Case #:		
19.5.3	Trainee successfully completed and passed an Oral Board for Module 19.0		

Additional Notes:

Signatures below represent successful completion of Training Module 19.0.

_____ _____ _____

Trainee/Date Technical Lead/Date Unit Manager/Date

20.0 Testing for Other Unknown Substances (GHB, Benzodiazepines, Barbiturates, Anabolic Steroids)

20.1 Objectives:

20.1.1 Familiarity with GHB and pro-drugs (butanediol and GBL)

- 20.1.1.1 Description/recognition of suspected GHB products
- 20.1.1.2 Production and use of GHB
- 20.1.1.3 Methods for confirming the presence of GHB
- 20.1.1.4 Structures and pharmacology of GHB and GBL
- 20.1.1.5 Legal aspects concerning GHB and GBL

20.1.2 Familiarity with Benzodiazepines

- 20.1.2.1 Description/recognition of suspected benzodiazepines
- 20.1.2.2 Trade name information and physical identification of pharmaceutically made benzodiazepines
- 20.1.2.3 Medical uses and legal aspects concerning benzodiazepines
- 20.1.2.4 Structures and pharmacology of benzodiazepines
- 20.1.2.5 Designer benzodiazepines (Etizolam, Flualprazolam, etc.)

20.1.3 Familiarity with Barbiturates

- 20.1.3.1 Description/recognition of suspected barbiturates
- 20.1.3.2 Trade name information and physical identification of pharmaceutically made barbiturates
- 20.1.3.3 Medical uses and legal aspects concerning barbiturates
- 20.1.3.4 Structures and pharmacology of barbiturates

20.1.4 Familiarity with Anabolic Steroids

- 20.1.4.1 Description/recognition of suspected anabolic steroids
- 20.1.4.2 Trade name information and physical identification of pharmaceutically made anabolic steroids
- 20.1.4.3 Medical uses and legal aspects concerning anabolic steroids
- 20.1.4.4 Structures and pharmacology of anabolic steroids

20.1.5 Familiarity with Other Unknown Substances

- 20.1.5.1 GC-MS methods available; Column length, Separation techniques
- 20.1.5.2 Early vs. late eluting compounds

20.1.5.3 Trouble-shooting and external identification resources/available libraries

20.1.6 Familiarity with the protocol for the analysis of GHB, Barbiturates, Benzodiazepines, Anabolic steroids, and other unknown substances (including physical identification, sampling, extraction, presumptive tests (color), GC, GC-MS, LC-MS, FT-IR, and analytical challenges).

20.1.7 Familiarity with additional analytical techniques for the analysis of GHB, Barbiturates, Benzodiazepines, Anabolic steroids, and other unknown substances.

20.2 Reading Material:

20.2.1 FCS20 – Procedure for the Derivatization of GHB (Document Control #9082)

20.2.2 "Terminology and Information on Drugs". UNODC. 2016. (7. – Central Nervous System (CNS) Depressants)

20.2.3 "Recommended Methods for the Identification and Analysis of Barbiturates and Benzodiazepines under International control", UNODC, ST/NAR/46, June 2012.

20.2.4 "Drugs of Abuse." Drug Enforcement Agency (2022 or latest edition) (Depressants; Steroids; Drugs of Concern)

20.3 Study/Discussion Questions:

20.3.1 What was the original medical use of GHB?

20.3.2 Name two analogs of GHB?

20.3.3 GBL and butanediol are known as prodrugs. What does this mean?

20.3.4 Can IR be used to distinguish GHB from GBL?

20.3.5 What is the process to analyze GHB in FCU?

20.3.6 Why is derivatization necessary for the confirmation of GHB by GC-MS?

20.3.7 Barbiturates are derived from what compound?

20.3.8 How are barbiturates categorized? What are the categories?

20.3.9 Name three barbiturates.

20.3.10 What are the trade names of the following substances: Diazepam, Flurazepam, Lorazepam, Alprazolam?

20.3.11 List three medical uses of benzodiazepines.

20.3.12 What is the process to analyze benzodiazepines?

20.3.13 Name three anabolic steroids.

20.3.14 Which validated method should be used for identifying steroids or other late eluting compounds?

20.3.15 What are some online resources that can assist with the identification of new or unknown controlled dangerous substances that do not currently exist in a library?

Note: Study/discussion questions may be incorporated into mini oral quiz sessions or a written exam to evaluate the trainee's understanding of topics covered in this module. It is the discretion of the trainee to answer questions for their training binder.

20.4 Practical Exercises/Skills:

20.4.1 Observe qualified chemist(s) perform qualitative analysis of GHB, Benzodiazepines, Barbiturates, Anabolic Steroids, or other unknown substances using the methods outlined in the FCU SOPs on a minimum of three cases. Observe and review casework note-taking and documentation. On the 30-Day Progress Report form, record the following: case number, qualified analyst(s) observed, date of observation, type of exam and number of items.

20.4.2 Demonstrate successful identification of a GHB, benzodiazepine, barbiturate, anabolic steroid, or other unknown substance by completion of a training case observed by the trainer. Record results on worksheets as appropriate and take notes according to laboratory protocol. *NOTE: Must be completed prior to trainee proceeding to independent exercises. Training case should consist of the following techniques:

20.4.2.1 Physical Identification, if applicable

20.4.2.1.1 Perform physical identification using approved resources to presumptively identify a pharmaceutical imprint provided by the trainer. Document imprint and resource used.

20.4.2.2 Color Test, if applicable

20.4.2.2.1 Perform the Marquis color test and document observed color changes.

20.4.2.2.2 Perform the Cobalt Thiocyanate color test and document observed color changes.

20.4.2.3 GC-MS and GC-FID

20.4.2.3.1 Perform an extraction and document results of GC-MS. Perform structural identification on confirm the presence of controlled dangerous substances, if applicable.

20.4.2.3.2 Perform an extraction and document results of GC-FID, if necessary. Confirm the presence of controlled dangerous substances, if applicable.

20.4.3 Perform independent examination and identification of a GHB, benzodiazepine, barbiturate, anabolic steroid, or other unknown substance on a minimum of three training case samples, representative of samples routinely encountered in casework. Use methods outlined in the laboratory FCU SOPs. Document on the 30-Day Progress Report form. Practice cases shall be reviewed for accuracy of analysis and conclusions.

20.5 Demonstration of Competency:

20.5.1 Practical Exercises are successfully completed, results in the form of notes and/or photographs (where applicable) are included in training binder, and the trainer has reviewed for accuracy and meeting the objectives of the exercise(s). The trainer(s) may also sign off on the module by oral discussion/proof of understanding of the material by the trainee.

20.5.2 Practical Exam: Successful analysis and identification of a GHB, benzodiazepine, barbiturate, anabolic steroid, or other unknown substance using FCU Standard Operating Procedures. Note: Completed independent training cases may be used as the practical exam.

20.5.3 Oral Board Exam – Testing for Other Unknown Substances (GHB, Benzodiazepines, Barbiturates, Anabolic Steroids). Trainee must successfully complete an oral board, addressing in detail all topics outlined in the Objectives.

20.6 Documentation:

20.6.1 Completion of the tasks in this module will be documented on the checklist titled “Module 20.0 Checklist – Testing for Other Unknown Substances (GHB, Benzodiazepines, Barbiturates, Anabolic Steroids).”

MODULE 20.0 CHECKLIST
Testing for Other Unknown Substances (GHB, Benzodiazepines, Barbiturates, Anabolic Steroids)

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
20.2	Complete required readings for Module 20.0		
20.3	Complete Study/Discussion Questions for Module 20.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
20.4.1	Observe examination and identification of GHB, Benzodiazepines, Barbiturates, Anabolic Steroids, or other unknown substances in casework samples		
	Case #:		
	Case #:		
	Case #:		
20.4.2	Demonstrate examination and identification of GHB, Benzodiazepines, Barbiturates, Anabolic Steroids, or other unknown substances in a supervised training case		
	Case #:		
20.4.3	Perform independent examination and identification of GHB, Benzodiazepines, Barbiturates, Anabolic Steroids, or other unknown substances in training case samples		
	Case #:		
	Case #:		
	Case #:		
DEMONSTRATION OF COMPETENCY			
		Trainee Initials & Date	**Trainer Initials & Date**
20.5.2	Practical exam: Trainee correctly identified the presence of GHB, Benzodiazepines, Barbiturates, Anabolic Steroids, or other unknown substances in an unknown sample Case #:		
20.5.3	Trainee successfully completed and passed an Oral Board for Module 20.0		

Additional Notes:

Signatures below represent successful completion of Training Module 20.0.

Trainee/Date	Technical Lead/Date	Unit Manager/Date

21.0 Syringe Processing, Surveillance, and Needle-Exchange Program

21.1 Objectives:

21.1.1 Familiarity with how to process syringe residue

21.1.2 Familiarity with special safety precautions associated with syringe processing

21.1.3 Familiarity with FCU policy and exceptions for processing syringes in casework

21.1.4 Familiarity with the FCU Surveillance Program and FCU Needle Exchange Program

21.1.5 Familiarity with distribution of monthly reports and associated networks

21.2 Reading Material:

21.2.1 FCS04 – SOP for Safe Handling and Analysis for CDS in Syringes (Document Control #5920)

21.2.2 FCU Syringe Research Guide

21.3 Study/Discussion Questions:

21.3.1 What are the necessary safety precautions when handling syringes?

21.3.2 What criteria allows for FCU to process casework syringes as an exception to regular policy?

21.3.3 Describe the difference between FCU surveillance cases and regular casework.

Note: Study/discussion questions may be incorporated into mini oral quiz sessions or a written exam to evaluate the trainee's understanding of topics covered in this module. It is the discretion of the trainee to answer questions for their training binder.

21.4 Practical Exercises/Skills:

21.4.1 Observe qualified chemist(s) perform testing for CDS in death investigation and Needle-Exchange syringes on a minimum of three samples (at least one of each type). Observe and review casework note-taking and documentation. On the 30-Day Progress Report form, record the following: case number, qualified analyst(s) observed, date of observation, type of exam and number of items.

21.4.2 Demonstrate successful identification of CDS in syringes by completion of a training case observed by the trainer. Record results on worksheets as appropriate and take notes according to laboratory protocol. *NOTE: Must be completed prior to trainee proceeding to independent exercises.

21.4.3 Perform independent examination and identification of CDS in a syringe training case sample. Use methods outlined in the laboratory FCU SOPs. Document on the 30-Day Progress Report form. Practice case shall be reviewed for accuracy of analysis and conclusions.

21.4.4 Complete the FCU Syringe Surveillance Processing Supplemental Training Checklist for surveillance/research authorization.

21.5 Demonstration of Competency:

21.5.1 Practical Exercises are successfully completed, results in the form of notes and/or photographs (where applicable) are included in training binder, and the trainer has reviewed for accuracy and meeting the objectives of the exercise(s). The trainer(s) may also sign off on the module by oral discussion/proof of understanding of the material by the trainee.

21.5.2 Practical Exam: Successful analysis and identification of CDS in a syringe using FCU Standard Operating Procedures. Note: Completed independent training case may be used as the practical exam.

21.6 Documentation:

21.6.1 Completion of the tasks in this module will be documented on the checklist titled "Module 21.0 Checklist – Syringe Processing, Surveillance, and Needle Exchange Program”

MODULE 21.0 CHECKLIST
Syringe Processing, Surveillance, and Needle Exchange Program

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
21.2	Complete required readings for Module 21.0		
21.3	Complete Study/Discussion Questions for Module 21.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
21.4.1	Observe examination and identification of CDS in death investigation and needle exchange syringes		
	Death investigation Case #:		
	Needle Exchange Case #:		
	Death investigation/Needle Exchange Case #:		
21.4.2	Demonstrate examination and identification of CDS in a supervised training case syringe		
21.4.3	Perform independent examination and identification of CDS in a training case syringe		
21.4.4	Complete the FCU Syringe Surveillance Processing Supplemental Training Checklist		
DEMONSTRATION OF COMPETENCY			
		Trainee Initials & Date	**Trainer Initials & Date**
21.5.2	Practical exam: Trainee correctly identified the presence of CDS in an unknown syringe sample Case #:		

Additional Notes:

Signatures below represent successful completion of Training Module 21.0.

Trainee/Date	Technical Lead/Date	Unit Manager/Date

22.0 Case Documentation and LIMS

22.1 Objectives:

22.1.1 Familiarity with CDS Worksheet.

22.1.2 Familiarity with FCU Report Template.

22.1.3 Familiarity with LIMS Procedures (current software) including, but not limited to, the following:

22.1.3.1 Entering of descriptions
22.1.3.2 Sub-itemization
22.1.3.3 Entering results and conclusions
22.1.3.4 Generating worksheets and reports
22.1.3.5 Signing reports
22.1.3.6 Entering case activities
22.1.3.7 Uploading attachments

22.1.4 Familiarity with Chain of Custody.

22.1.5 Familiarity with other documentation (discrepancy forms, request forms, property forms)

22.1.6 Familiarity with building a case packet and making changes after technical and administrative reviews

22.2 Reading Material:

22.2.1 FCS06 – SOP for Casework Documentation, Writing Reports, and Reviewing Reports (Document Control #5162)

22.2.2 A Guide to FCU Case Management

22.3 Study/Discussion Questions:

22.3.1 What documentation goes in a completed case report?

22.3.2 What is the order of documentation?

22.3.3 How do you sign an electronic case report?

22.3.4 What is the process for making changes to a case packet after technical and administrative review? What documentation should be kept?

Note: Study/discussion questions may be incorporated into mini oral quiz sessions or a written exam to evaluate the trainee's understanding of topics covered in this module. It is the discretion of the trainee to answer questions for their training binder.

22.4 Practical Exercises/Skills:

22.4.1 Understand general casework documentation, organization and content by observing qualified chemist(s) take notes during casework. Types of cases should include qualitative and quantitative analysis. Obtain copies of worksheets to study and refer to if necessary.

22.4.2 Understand general reporting format by observing qualified chemist(s) input results in LIMS, generate the report and worksheets, and complete a case report packet for various cases. Types of cases should include qualitative and quantitative analysis. Obtain copies of completed case packets to study and refer to if necessary.

22.4.3 Submit at least ten completed practice case packets to trainer for review and approval. Each packet should include all relevant documentation and organized according to FCU procedures. Note: Completed case packets for other modules may be used to fulfill requirement.

22.5 Demonstration of Competency:

22.5.1 Practical Exercises are successfully completed, results in the form of notes and/or photographs (where applicable) are included in training binder, and the trainer has reviewed for accuracy and meeting the objectives of the exercise(s). The trainer(s) may also sign off on the module by oral discussion/proof of understanding of the material by the trainee.

22.6 Documentation:

22.6.1 Completion of the tasks in this module will be documented on the checklist titled "Module 22.0 Checklist – Case Documentation and LIMS"

MODULE 22.0 CHECKLIST
Case Documentation and LIMS

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
22.2	Complete required readings for Module 22.0		
22.3	Complete Study/Discussion Questions for Module 22.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
22.4.1	Observe casework documentation, organization, and content		
22.4.2	Observe entering of results, generation of report and worksheets, and completion of case report packets		
22.4.3	Submit ten completed training case packets		
	Case #:		
	Case #:		
	Case #:		
	Case #:		
	Case #:		
	Case #:		
	Case #:		
	Case #:		
	Case #:		
	Case #:		

Additional Notes:

Signatures below represent successful completion of Training Module 22.0.

_____	_____	_____
Trainee/Date	Technical Lead/Date	Unit Manager/Date

23.0 Technical/Administrative Review

23.1 Objectives:

23.1.1 Develop and demonstrate an understanding of how to properly conduct technical and/or administrative reviews in accordance with the requirements of the Forensic Science Laboratory Quality Assurance Manual and Standard Operating Procedures.

23.2 Reading Material:

23.2.1 FSL Quality Assurance Manual (QAM) (Document Control #10154)

23.2.2 FCS06 – SOP for Casework Documentation, Writing Reports, and Reviewing Reports (Document Control #5162)

23.2.3 FCF02 – FORM FCU PACKET REVIEW (current revision)

23.3 Study/Discussion Questions:

23.3.1 Define technical review.

23.3.2 Who is authorized to conduct a technical review?

23.3.3 Define administrative review.

23.3.4 Who is authorized to conduct an administrative review?

23.3.5 What documentation must be completed for both technical and administrative reviews?

Note: Study/discussion questions may be incorporated into mini oral quiz sessions or a written exam to evaluate the trainee's understanding of topics covered in this module. It is the discretion of the trainee to answer questions for their training binder.

23.4 Practical Exercises/Skills:

23.4.1 Observe qualified chemist(s) perform technical and administrative review process on at least three case reports. Observe procedure and note the forms (technical and administrative checklists) used during the process. On the 30-Day Progress Report form, record the following: case number, qualified chemist(s) observed, date of observation, type of exam and number of items.

23.4.2 As applicable, trainee must conduct five supervised administrative reviews on case files and documents consisting of various types and complexities routinely performed by the FCU. Reviews will be

documented on the “Supervised Technical/Administrative Review Worksheet” (Document Control Number 13202).

23.4.3 As applicable, trainee must conduct 5 - 10 supervised technical reviews on case files consisting of various types and complexities routinely performed by FCU. Reviews will be documented on the “Supervised Technical/Administrative Review Worksheet” (Document Control Number # 13202).

Note: *Throughout the training program, the Trainee is expected to gather case notes and reports of qualified individuals to use as examples for learning how to take case notes and write reports of their own. Throughout the training program, the Trainee should also use reports for practice on technical and administrative reviews. Reviews and any questions regarding developing case notes, writing reports, and the technical and administrative review process should be discussed with Trainer(s). As the Trainee progress through training, their knowledge and ability to work independently with case notes, report writing and conducting reviews should increase.*

23.5 Demonstration of Competency:

23.5.1 Practical exercises are successfully completed, results in the form of notes and/or photographs (where applicable) are included in training binder, and the trainer has reviewed for accuracy and meeting the objectives of the exercise(s).

23.5.2 The Trainee must successfully complete an unsupervised administrative review competency test prior to approval to perform independent administrative reviews.

23.5.3 The Trainee must successfully complete an unsupervised technical review competency test prior to approval to perform independent technical reviews.

23.6 Documentation:

23.6.1 Completion of the tasks in this module will be documented on the checklist titled "Module 23.0 Checklist – Technical/Administrative Review".

MODULE 23.0 CHECKLIST
Technical and Administrative Review

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
23.2	Complete required readings for Module 23.0		
23.3	Complete Study/Discussion Questions for Module 23.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
23.4.1	Observe technical and administrative review		
	Case #:		
	Case #:		
	Case #:		
23.4.2	Conduct supervised administrative reviews and document on "Supervised Technical/Administrative Review Worksheet"		
23.4.3	Conduct supervised technical reviews and document on "Supervised Technical/Administrative Review Worksheet"		
DEMONSTRATION OF COMPETENCY			
		Trainee Initials & Date	**Trainer Initials & Date**
23.5.2	Trainee successfully completed and passed an unsupervised administrative review competency test		
23.5.3	Trainee successfully completed and passed an unsupervised technical review competency test		

Additional Notes:

Signatures below represent successful completion of Training Module 23.0.

_____ _____ _____

Trainee/Date Technical Lead/Date Unit Manager/Date

24.0 Ethical and Legal Overview/Expert Testimony/Mock Trial

24.1 Objectives:

24.1.1 To gain familiarity with courtroom etiquette and to gain experience in presenting scientific results in accurate but non-technical terms in a court of law.

24.1.2 The trainee should have a general understanding of the legal system to include both criminal and civil law.

24.1.3 The trainee should have an understanding of the principles of courtroom etiquette and presentation of evidence, which may include but are not limited to the following:

- 24.1.3.1 Courtroom demeanor and attire
- 24.1.3.2 Courtroom procedures and rules
- 24.1.3.3 Rules of evidence packaging and handling in the courtroom setting
- 24.1.3.4 Chemist qualifications
- 24.1.3.5 Technical testimony
- 24.1.3.6 Discovery issues
- 24.1.3.7 General guidelines and Frye and Daubert hearing procedures
- 24.1.3.8 Ethical responsibilities of the expert witness
- 24.1.3.9 Appropriate public speaking etiquette
- 24.1.3.10 Significance of accreditation

24.2 Reading Material:

24.2.1 Current DFS and FSL administrative policies including DOMs and FSL LOMs regarding court testimony and monitoring.

24.2.2 University of Minnesota. “Chapter 1.3: The Difference between Civil and Criminal Law.” Criminal Law, University of Minnesota Libraries, 2015, pp. 6-12.

24.2.3 Bowen, Robin T. “Chapter 5: Ethics in Forensic Science.” *Ethics and the Practice of Forensic Science*, CRC Press, 2010, pp. 57-74. (Available in DFS library)

24.2.4 Legal Accountability

- 24.2.4.1 Bullcoming vs. New Mexico (US S. Ct. 2011)
- 24.2.4.2 Melindez-Diaz vs. Massachusetts (US S. Ct. 2009)
- 24.2.4.3 Crawford v. Washington (US S. Ct. 36 2004)

24.2.4.4 Brady vs. Maryland (US S Ct. 1963)
24.2.4.5 Giglio vs. United States (US S. Ct. 1972)
24.2.4.6 Jencks Act (18 USC §3500)
24.2.4.7 Confrontation Clause (6th Amendment, US Constitution)

24.2.5 Legal Obligations: Federal Rules of Criminal Procedure

24.2.5.1 Rule 16: Discovery and Inspection
24.2.5.2 Rule 17: Subpoena (ad Testificandum vs. Duces Tecum)

24.2.6 Evidence Admissibility

24.2.6.1 Fry vs. United States (DC Cir. 1972)
24.2.6.2 Fry Standard-General acceptance and be scientifically sound
24.2.6.3 Daubert vs. Merrell Dow Pharmaceuticals (US S. Ct. 1993)
24.2.6.4 Daubert Standard: Relevance and Reliability
24.2.6.5 Prongs of Daubert (Method Criteria for Acceptance):
24.2.6.6 Federal Rules of Evidence: 403, 701, 702, 703, 704, 705, 706
24.2.6.7 Legal Codes
24.2.6.8 Scheduling by Synthetics Abatement and Full Enforcement Drug Control Act of 2015 (“SAFE DC”)
24.2.6.9 Title 21 United States Code (USC) Controlled Substances Act
24.2.6.10 DC Special Order: Legalization of Possession of Minimal Amounts of Marijuana for Personal Use Initiative of 2015 (D.C. Act 20-565), “Initiative 71”

24.2.7 Organizations

24.2.7.1 Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG)
24.2.7.2 OSAC Seized Drugs Subcommittee: https://www.nist.gov/topics/forensic-science/seized-drugs-subcommittee
24.2.7.3 OSAC Registry: https://www.nist.gov/topics/forensic-science/organization-scientific-area-committees-osac/osac-registry/osac-approved

24.3 Study/Discussion Questions:

24.3.1 Complete brief summaries for the following:

24.3.1.1 Bullcoming vs. New Mexico (US S. Ct. 2011)
24.3.1.2 Melindez-Diaz vs. Massachusetts (US S. Ct. 2009)

24.3.1.3 Crawford v. Washington (US S. Ct. 36 2004)
24.3.1.4 Brady vs. Maryland (US S Ct. 1963)
24.3.1.5 Giglio vs. United States (US S. Ct. 1972)
24.3.1.6 Jencks Act (18 USC §3500)
24.3.1.7 Confrontation Clause (6th Amendment, US Constitution)
24.3.1.8 Grand Jury - True Bill vs. No Bill
24.3.1.9 Rule 16: Discovery and Inspection
24.3.1.10 Rule 17: Subpoena (ad Testificandum vs. Duces Tecum)
24.3.1.11 Fry vs. United States (DC Cir. 1972)
24.3.1.12 Daubert vs. Merrell Dow Pharmaceuticals (US S. Ct. 1993)
24.3.1.13 Scheduling by Synthetics Abatement and Full Enforcement Drug Control Act of 2015 ("SAFE DC")
24.3.1.14 Title 21 United States Code (USC) Controlled Substances Act

24.4 Practical Exercises/Skills:

24.4.1 Observe multiple qualified forensic analyst(s)/technician(s) (as available) testify in court and take notes as to courtroom attire, courtroom procedure (e.g., swearing in, direct, cross, and re-direct and/or re-cross questioning, etc.), evidence handling (if applicable), qualifying questions, technical testimony, and any other pertinent observations. On the FCU 30 Day Progress Report form (Document Control Number: 12397), record the following: case number, qualified analyst(s)/technician(s) observed, date of observation. Prior to testimony observation, perform the following tasks:

24.4.1.1 Review theoretical and practical aspects of the techniques performed during evidence testing for the particular case at hand.
24.4.1.2 Discuss with qualified analyst(s)/technician(s) some potential questions to be asked during qualifications, direct examination, and cross-examination.
24.4.1.3 After the court proceedings, review the testimony with the analyst/technician.

Note: Due to the nature of sporadic opportunities to witness FCU members testifying, the Trainee is encouraged to observe as many testimonies as possible during their training period and document accordingly.

24.4.2 Courtroom testimony question and answer training session with trainer, General Counsel, or designee including but not limited to, the following topics:

24.4.2.1 Qualifying/*Voir dire* questions

24.4.2.2 Direct examination
24.4.2.3 Cross examination
24.4.2.4 Explanation of analytical processes and SOPs

24.5 Demonstration of Competency:

24.5.1 Successful passing of at least one external comprehensive mock trial, with a maximum of two mock trials provided. Guidelines for Mock Trial are as follows:

24.5.1.1 The trainee will be evaluated as an expert witness in the field of Forensic Chemistry.
24.5.1.2 The atmosphere of the trial should be formal. It should be conducted in the same manner as a real courtroom situation. This includes conduct, protocol, and all other aspects.
24.5.1.3 Harassment of the expert witness by the defense counsel or prosecutor should be kept to the minimum necessary to achieve the desired goal. Questioning by both the prosecutor and defense attorney should be relevant and realistic.
24.5.1.4 The participants can include a judge, prosecutor, and defense. Mock Trials require five (5) evaluators, with four (4) evaluators being subject matter experts and one (1) evaluator being a member of the Training Unit. Each evaluator is required to score the witness using the Mock Trial Scoring Sheet (Document Control Number 7495). Scores will be tallied by each evaluator and combined for a final score. Passing score for a final mock trial is a combined score of 80% or greater.
24.5.1.5 The "attorneys" must be qualified scientists(s), lawyer(s), or suitable individual(s) designated by the FCU Unit Manager/Technical Leader, and/or DFS HR Director. It is desirable that this person has knowledge in the area in which the trainee will be testifying. FSL Management reserves the right to use attorneys from stakeholder agencies as participants, evaluators, and/or observers to the mock trials.
24.5.1.6 Permitting “observers" is at the discretion of the FSL Director and/or FCU Management. Observers can review and provide feedback to the trainee as to performance; however, they will not be a grading evaluator.
24.5.1.7 Mock Trials may be videotaped and provided to the trainee as a feedback mechanism.

24.5.1.8 Evaluators will orally provide feedback on performance with the trainee immediately following the mock trial. The FCU Unit Manager/Technical Leader will provide feedback in writing of any deficiencies and pass/fail status.

24.6 Documentation:

24.6.1 Completion of the tasks in this module will be documented where applicable on the checklist titled “Module 24.0 Checklist - Legal Overview/Expert Testimony/Mock Trial”, the Mock Trial Scoring sheet and formal documentation of pass/fail from FCU Unit Manager/Technical Leader.

MODULE 24.0 CHECKLIST
Legal Overview/Expert Testimony/Mock Trial

Trainee: _____ Trainer: _____

THEORY			
		Trainee Initials & Date	**Trainer Initials & Date**
24.2	Complete required readings for Module 24.0		
24.3	Complete Study/Discussion Questions for Module 24.0		
PRACTICAL EXERCISES/SKILLS			
		Trainee Initials & Date	**Trainer Initials & Date**
24.4.1	Observe analysts testify in court		
	Case #:		
	Case #:		
24.4.2	Participate in training session with legal staff, trainer, or designee		
DEMONSTRATION OF COMPETENCY			
		Trainee Initials & Date	**Trainer Initials & Date**
24.5.1	Trainee successfully completed and passed an external mock trial		

Additional Notes:

Signatures below represent successful completion of Training Module 24.0.

_____	_____	_____
Trainee/Date	Technical Lead/Date	Unit Manager/Date

25.0 Competency Tests

25.1 Objectives:

25.1.1 To successfully complete and pass a **qualitative** competency assessment by confirming the presence of a Controlled Dangerous Substance versus a negative control and/or Non-Controlled Substance using FCU Standard Operating Procedures, Methods, and Instrumentation.

25.1.2 To successfully complete and pass a **quantitative** competency assessment by determining the purity (%) of Heroin in a submitted sample using FCU Standard Operating Procedures, Methods, and Instrumentation.

25.2 Reading Material:

25.2.1 N/A

25.3 Study/Discussion Questions:

25.3.1 N/A

25.4 Practical Exercises/Skills:

25.4.1 N/A

25.5 Demonstration of Competency:

25.5.1 Competency Exam: Successful **qualitative** analysis of a Controlled Dangerous Substance versus a negative control and/or Non-Controlled Substance using standard methods. A passing score of 100% must be achieved by correct identification of all substances.

25.5.2 Competency Exam: Successful **quantitative** analysis of a Heroin sample using standard methods. The trainee must achieve a z-score ≤2 in order to receive a passing score.

25.6 Documentation:

25.6.1 Completion of the tasks in this module will be documented where applicable on the checklist titled “Module 25.0 - Competency Tests” and formal documentation of pass/fail from FCU Technical Lead (or designee).

MODULE 25.0 CHECKLIST
Competency Tests

Trainee: _____ Trainer: _____

DEMONSTRATION OF COMPETENCY			
		Trainee Initials & Date	**Trainer Initials & Date**
25.5.1	Trainee successfully completed and passed a **qualitative** competency test		
25.5.2	Trainee successfully completed and passed a **quantitative** competency test		

Additional Notes:

Signatures below represent successful completion of Training Module 25.0.

_____ _____ _____

Trainee/Date Technical Lead/Date Unit Manager/Date